



## **ZD30DDTi Common Rail Diesel Engine**

**Y61 Patrol Wagon  
UY61 Cab Chassis**

# Foreword

The information in this Training Manual should not be interpreted as a basis for warranty or goodwill claims against Nissan Motor Co. (Australia) Pty. Ltd. (NMA) unless so designated.

This Technical Training Manual is intended for use by NMA & Nissan Dealership Technical Personnel. It is not designed for the use by press or for customer distribution.

Before quoting any specifications be sure to check the relevant Service Manual and Technical Bulletins.

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# NISSAN Learning Academy

ZD30DDTi CRD Engine

Nissan Australia July 2008

## ABOUT THIS TRAINING MANUAL

The purpose of this document is for Nissan Dealer Technical Staff SELF STUDY purposes. If anything contained within this document gives any doubt, please contact Nissan via a Non Vehicle related TechLine enquiry to clarify the information within this document.

The information in this training manual should not be interpreted as a basis for warranty or goodwill claims against Nissan Motor Co. (Australia) Pty. Ltd. (NMA) unless so designated.

## FUTURE UPDATE'S OF THIS TRAINING MANUAL?

Additional information will be collated & added to this document at a later date. When this does occur, a special amendment document will be published on the new Nissan Learning Academy.

Go to [www.nissanlearningacademy.com.au](http://www.nissanlearningacademy.com.au) for more detail.

This actual Training Manual will also be readily available at anytime for download & printing within each Nissan Dealership.

## Y61 SERVICE MANUAL (ESM)

All Y61 (1997 ~ 2008 > ); **SM7E-5Y61G3**

This ESM has been automatically issued to ALL Nissan dealers (via the parts distribution system) If your dealership does not have one, they can be ordered via normal parts channels using the above quoted publication numbers..

This Training Manual is designed for the purpose of relaying information about the vehicle & the systems within it. This Training Manual is NOT to be used as the Service Manual. Throughout this Training Manual, references are made to the Service Manual for additional information regarding fault diagnosis, repairs &/or maintenance.

Once again should there be any doubt, please contact TechLine.

## SERVICE TECHNICAL BULLETINS (STB's)

Please ensure you familiarise yourselves with all STB's relating to Y61

Once the screen where all STB's are accessed, click on the "by Model" link & then all the STB's will be re-sorted so that all the model code related STB's are together.

The screenshot shows the Nissan Dealer TechLine website interface. At the top, there are navigation links: HOME, DEALER DIRECTORY, WISCOM MANUAL, and CONTACT US. Below this, the page title is 'Communication Square Australia' and there is a search bar. The main content area is titled 'TechLine Technical Bulletins' and has a sub-header 'by Model'. A list of model codes is displayed, including ALL, NONE, A32, A33, B13, C11, C23, D21, D22, D40, E24, F22, J10, J30, R51, S14, S15, T30, and T31. Two arrows point to the 'by Model' link and the list of model codes.

1. Click on "by Model"
2. Look for the vehicle model code from the list

## How to use the Y61 Service Manual (ESM) SM7E-5Y61G3

This image below is what appears on the screen of the computer when the ESM (CD) is installed in the disc drive of the computer, a window (which will automatically appear) containing an icon called "Start" is double clicked & then the button marked "Service Manual" is clicked on.

NISSAN

# Y61

~~Technical Bulletin~~

Return to Start Page

Service Manual List

|     | Item                                   | Applicable from     | Check VIN Code                             | Publication No.        | LINK   |                |
|-----|--|---------------------|--|------------------------|--|----------------|
| Y61 | Supplement for Australia               | Sep.2007            | Go!  | TB(SM07-96)            | Click !  | ← 1 CD only    |
|     | Supplement X 1st Revision              | Jan.2007            | Go!  | SM7E-Y61KG1            | Click !  | ← 2 CD only    |
|     | Supplement IX 1st Revision             | Jun.2006            | Go!  | SM6E-Y61JG1            | Click !  | ← 3 CD only    |
|     | Supplement VIII 1st Revision           | Jun.2004            | Go!  | SM4E-Y61HG1            | Click !  | ← 4 CD & Book  |
|     | <del>Supplement VII 2nd Revision</del> | <del>Sep.2003</del> | <del style="text-align: center;">Go!</del> | <del>SM4E-Y61GG2</del> | <del style="text-align: center;">Click !</del> | <del>NFA</del> |
|     | Supplement VI 1st Revision             | Jun.2002            | Go!  | SM2E-Y61FG1            | Click !  | ← 5 CD & Book  |
|     | Supplement V 1st Revision              | Jun.2001            | Go!  | SM1E-Y61EG1            | Click !  | ← 6 CD & Book  |
|     | <del>Supplement IV</del>               | <del>Jul.2000</del> | <del style="text-align: center;">Go!</del> | <del>SM0E-Y61DG0</del> | <del style="text-align: center;">Click !</del> | <del>NFA</del> |
|     | Supplement III 3rd Revision            | Jul.1999            | Go!  | SM9E-Y61CG3            | Click !  | ← 7 CD & Book  |
|     | Supplement II 1st Revision             | Feb.1999            | Go!  | SM9E-Y61BG1            | Click !  | ← 8 CD & Book  |
|     | Supplement I                           | Jul.1998            | Go!  | SM8E-Y61AG0            | Click !  | ← 9 CD & Book  |
|     | First Edition 1st Rev.Volume 1         | Oct.1997            |  | SM7E-1Y61G1            | Click !  | ← 10 CD & Book |
|     | First Edition 1st Rev.Volume 2         | Oct.1997            |  | SM7E-2Y61G1            | Click !  | ←              |

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**DO NOT refer to these Tech Bulletins. Only refer to STB's released by Nissan Australia. They're located on INISCOM.**

**This new ESM supersedes ESM SM6E-5Y61G1 & SM7E-5Y61G2. Discard them & only refer to SM7E-5Y61G3.**

- 1 Supplement for Australia. This is for Cab Chassis variants with the ZD30-CRD engine.
- 2 Supplement X (10) for 2007 production vehicles (Primarily for ZD30-CRD engine vehicles)
- 3 Supplement IX (9) for 2006 production vehicles (Primarily for Euro III TB48DE engine vehicles)
- 4 Supplement VIII (8) for (late) 2004 ~ 2005 production vehicles. Major facelift with no mechanical changes.
- 5 Supplement VI (6) for 2003 production vehicles (Primarily for TD42 engine with turbo, intercooler & electronic fuel pump).
- 6 Supplement V (5) for (late) 2001 ~ 2002 production vehicles (Primarily for TB48DE engine vehicles)
- 7 Supplement III (3) for 2000 ~ 2001 production vehicles. (Primarily for ZD30 engine vehicles)
- 8 Supplement II (2) for 1999 production vehicles. (Primarily for TD42 with turbo only engine vehicles)
- 9 Supplement I (1) for 1998 (Minor running changes made. Typically wiring diagrams)
- 10 Original Service Manuals (Vol 1 & Vol 2) introduced in late 1997. Refer to these for information on TD42 non turbo, TB45E & RD28ETi engine vehicles.

**BEWARE:** Always select the manual relevant to the VIN. If the required detail cannot be found in that particular Supplement, simply go back to the next supplement down the list.  
 The basic rule of thumb is **start from the newest supplement** (or supplement relevant to the VIN / age of the vehicle) & work **backwards** until the required information is found.

# NISSAN Learning Academy

ZD30DDTi CRD Engine

Nissan Australia July 2008

## History & Service Manual Reference - Y61 Patrol 1997 ~ 2008

| Service Man reference.               | (Prod'd from) VIN | Model Year  | Comments regarding changes                          | Nissan Australia derived "Series" coding   |
|--------------------------------------|-------------------|-------------|---|--|
| *Supp X                              | JN1TESY61A0395001 | 2007MY ZD30 | New ZD30 - CRD Engine with ASCD                     | <b>Series V &amp; VI</b><br>ZD30-CRD engine with ASCD & CAN. TB48 no change since '06 Euro III. TD42 no longer available.<br><b>Mid 2007 changes:</b> ABS standard on all except DX. Special DX variant with 16" alloy wheels introduced.  |
|                                      | JN1TFSY61A0366001 | 2007MY TB48 | No change from '06MY                                |  |
| *Supp IX                             | JN1TESY61A0385001 | 2006MY ZD30 | 1 piece key but no other change from '05MY          | <b>Series IV</b><br>From August '04 production. Major Cosmetic Changes. Ti with Sat Nav/Rev Camera. All new Interior. Trim colour options. New style 5 spoke 17" alloy wheels. Larger square shaped wheel arch flares. Larger rear taillights. New headlights, bumper & grille. Available in DX, ST, ST-S, ST-L for ZD30 & TD42 engines. ST-S, ST-L & Ti for TB48 engines.<br><b>Changes for 2006:</b> 1 peice key/remote (except DX). Euro III TB48. New Sat Nav/Rev Camera system for Ti & option of ZD30 Ti variant from Sep't '06. |
|                                      | JN1TCSY61A0365001 | 2006MY TD42 | 1 piece key but no other change from '05MY          |  |
|                                      | JN1TFSY61A0365001 | 2006MY TB48 | 1 piece key, Euro III engine, No Sub Tank & No M/T  |  |
| *Supp VIII                           | JN1TESY61A0370001 | 2005MY ZD30 | Major Facelift + increase in Power & Torque for M/T | <b>Series III</b><br>From late 2001 production. Changes to taillights, headlights & grill. New style (6 spoke) 16" alloy wheels & new style Nissan Badges. New TB48DE petrol engine with 5 sp A/T.<br><b>Changes for 2003:</b> New TD42Ti (turbo intercooled) diesel engine with Cruise Control (except DX). New ST-L variant with rear A/C & leather trim introduced. ST-L available in all engine & transmission combinations.   |
|                                      | JN1TCSY61A0360001 | 2005MY TD42 | Major Facelift only. Mech unchanged                 |  |
|                                      | JN1TFSY61A0360001 | 2005MY TB48 | Major Facelift only. Mech unchanged                 |  |
| *Supp VI                             | JN1TESY61A0345001 | 2003MY ZD30 | No change from '02MY                                | <b>Series II</b><br>Minor facelift. New ZD30 engine for DX & ST. Ti gains side SRS airbags. ST gains keyless entry - hazards flash, Ti same. ST gains dual Airbag/ABS ("Safety Pack") as option. Drivers power window gains "Anti Pinch" function. TD42T (turbo) engine available in DX & ST. NATS on all engine options.  |
|                                      | JN1TCSY61A0345001 | 2003MY TD42 | New TD42Ti Engine with Cruise Control               |  |
|                                      | JN1TFSY61A0345001 | 2003MY TB48 | No change from '02MY                                |  |
| *Supp V                              | JN1TESY61A0330001 | 2002MY ZD30 | Facelift only                                       | <b>Series I</b><br>Y61 launched in December 1997 with TB45E engine only (ST & Ti). RD28ETi in ST & DX introduced January 1998. TD42 (non turbo) in DX only introduced in March 1998. NATS available on ALL models except TD42 engine. Keyless Entry ONLY on Ti variants - hazards do NOT flash.<br><b>Changes for 1999:</b> TD42T (turbo) introduced to ST wagons (along with intro of Cab Chassis). NATS not available on TD engine wagons.   |
|                                      | JN1TCSY61A0330001 | 2002MY TD42 | Facelift only                                       |  |
|                                      | JN1TFSY61A0330001 | 2002MY TB48 | Facelift & new TB48DE engine & 5 sp. A/T            |  |
| *Supp III                            | JN1TESY61A0300001 | 2000MY ZD30 | Minor facelift & new ZD30 engine                    | <b>Series I</b><br>Y61 launched in December 1997 with TB45E engine only (ST & Ti). RD28ETi in ST & DX introduced January 1998. TD42 (non turbo) in DX only introduced in March 1998. NATS available on ALL models except TD42 engine. Keyless Entry ONLY on Ti variants - hazards do NOT flash.<br><b>Changes for 1999:</b> TD42T (turbo) introduced to ST wagons (along with intro of Cab Chassis). NATS not available on TD engine wagons.   |
|                                      | JN1TCSY61A0300001 | 2000MY TD42 | Minor Facelift & NATS                               |  |
|                                      | JN1TBSY61A0300001 | 2000MY TB45 | Minor Facelift only                                 |  |
| *Supp II                             | JN1TCSY61A0110001 | 1999MY TD42 | TD42T engine intro running change. ST only          | <b>Series I</b><br>Y61 launched in December 1997 with TB45E engine only (ST & Ti). RD28ETi in ST & DX introduced January 1998. TD42 (non turbo) in DX only introduced in March 1998. NATS available on ALL models except TD42 engine. Keyless Entry ONLY on Ti variants - hazards do NOT flash.<br><b>Changes for 1999:</b> TD42T (turbo) introduced to ST wagons (along with intro of Cab Chassis). NATS not available on TD engine wagons.   |
| *Supp I                              | JN1TDSY61A0110001 | 1998MY RD28 | No change from original production                  |  |
|                                      | JN1TBSY61A0110001 | 1998MY TB45 | No change from original production                  |  |
| *Original Manuals<br>(Vol 1 & Vol 2) | JN1TDSY61A0100001 | 1998MY RD28 | Original production                                 | <b>Series I</b><br>Y61 launched in December 1997 with TB45E engine only (ST & Ti). RD28ETi in ST & DX introduced January 1998. TD42 (non turbo) in DX only introduced in March 1998. NATS available on ALL models except TD42 engine. Keyless Entry ONLY on Ti variants - hazards do NOT flash.<br><b>Changes for 1999:</b> TD42T (turbo) introduced to ST wagons (along with intro of Cab Chassis). NATS not available on TD engine wagons.   |
|                                      | JN1TCSY61A0100001 | 1998MY TD42 | Original production                                 |  |
|                                      | JN1TBSY61A0100001 | 1998MY TB45 | Original production                                 |  |

### Y61 Patrol Cab Chassis

|                                  |                   |             |                                     |  |
|----------------------------------|-------------------|-------------|-------------------------------------|--|
| *Supp for Australia              | JN1UENY610000101  | 2008MY ZD30 | Introduction of the ZD30-CRD engine | <b>Series III</b><br>Series IV wagon front styling has been adopted with the ZD30-CRD engine.  |
|                                  | JN1UELY610500101  | 2008MY ZD30 |                                     |  |
| *Supp X                          | JN1UCNY61A0026844 | 2006MY TD42 | Introduction of SRS Airbags         | <b>Series II</b><br>New TD42Ti Turbo I'cooled engine, new radiator, new grille & headlights for 2003 (front styling of Ser III wagon, interior style of Ser I wagon continues unchanged). NATS, Keyless Entry and Cruise Control NOT available on C/C.<br><b>From October 2006:</b> Dual SRS Airbag fitted to all variants except Coil DX. |
|                                  | JN1UCLY61A0524673 | 2006MY TD42 |                                     |  |
| *Supp VI                         | JN1UCNY61A0020101 | 2003MY TD42 | Facelift & new TD42Ti engine        | <b>Series I</b><br>Y61 C/C launched Feb '99. Intro of TD42T (turbo) for C/C & ST Wagon. No NATS or Keyless Entry.  |
|                                  | JN1UCLY61A0520101 | 2003MY TD42 |                                     |  |
| *Supp II<br>(& Original Manuals) | JN1UCNY61A0000101 | 1999MY TD42 | Original production                 | <b>Series I</b><br>Y61 C/C launched Feb '99. Intro of TD42T (turbo) for C/C & ST Wagon. No NATS or Keyless Entry.  |
|                                  | JN1UCLY61A0500101 | 1999MY TD42 | Original production                 |  |

\* Refer to this Service Manual / SM Supplement if the VIN matches or is HIGHER than the VIN shown to the right (but not higher than the VIN quoted in the group above). If the information cannot be found in a Supplement Manual, simply refer back to EARLIER Service Manual Supplements (go back 1 Manual at a time) until the information is located.  
Finding NO information on a specific system in the Supplement for a VIN simply means no change occurred on that specific system for that VIN breakpoint. Go back 1 Manual at a time until the required information is found.

### ZD30 ENGINE CODE DESCRIPTION

#### Y61 Diesel Engines .../Cont'd

**ZD30DDTi** (4 cylinder diesel engine)

**ZD** = Engine series code. The 'D' is common across all diesel engine codes

**30** = Engine capacity (3.0L)

**D** = Double Overhead camshafts

**D** = Direct Injection (as opposed to "indirect" injection as it is in the TD & RD engine series)

**T** = Turbo

**i** = intercooler

**Note 1;** None of the coding makes any reference to Electronic Control even though it is an electronically controlled engine.

**Note 2;** The same code applies to the CRD (Common Rail Diesel) version of this engine.

**Note 3;** All ZD30 engines are fitted with NATS (wagon only).

**Note 4;** Only ZD30 CRD engines from 2007 production have ASCD (Cruise Control – wagon only).

**Note 5;** ZD30 engine also applied to D22 Navara models from late 2001 ~ 2006 production. Engine has a conventional turbo, but no intercooler. (ZD30DDT)



ZD30DDTi (Non CRD; 2000 ~ 2006)



ZD30DDTi (CRD; 2007)



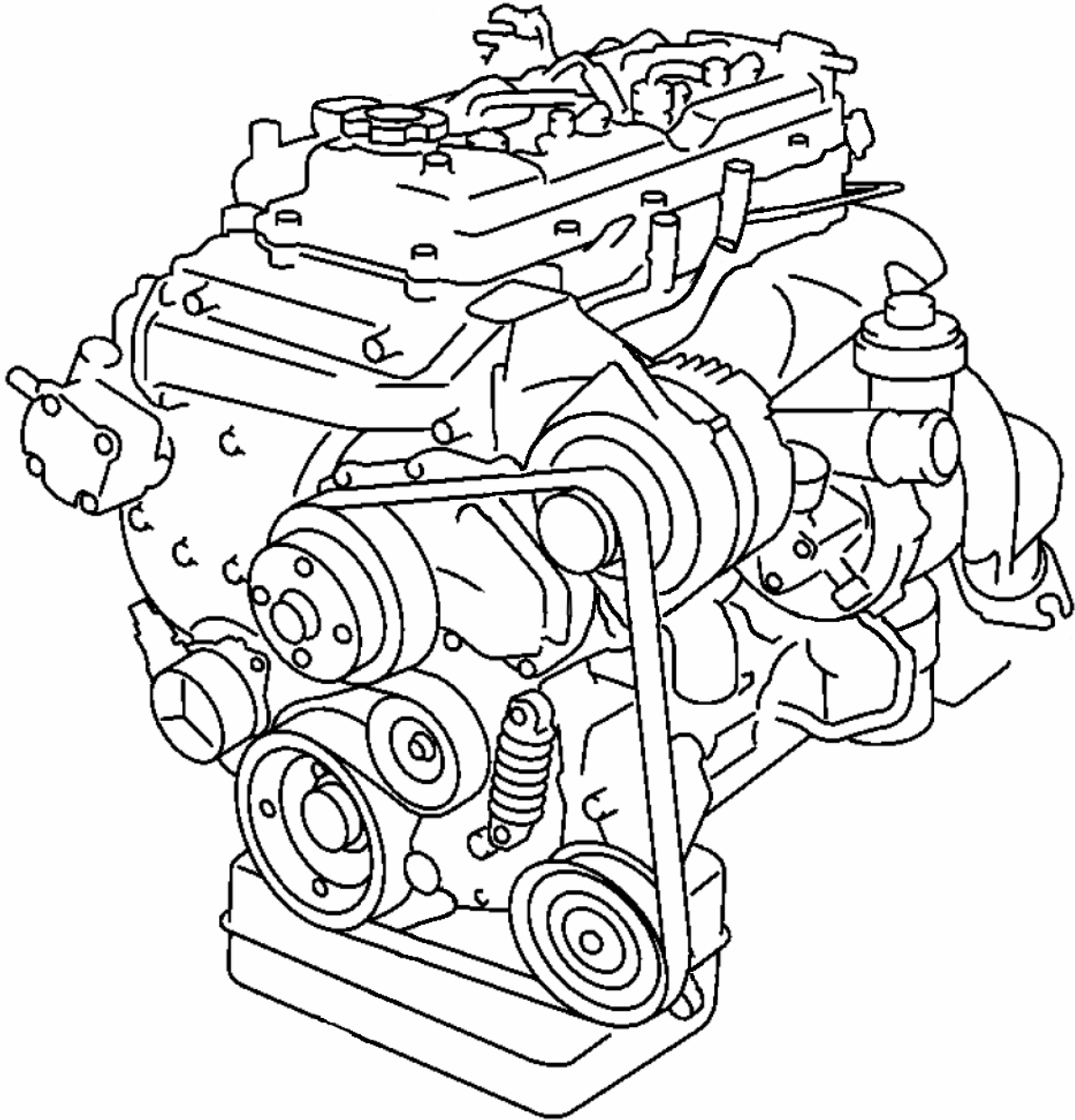
Rocker Cover ZD30DDTi CRD (2007)



Rocker Cover ZD30DDTi (2000 ~ 2006)

## ENGINE MECHANICAL - EM

### 2007 ZD30DDTi Common Rail Diesel (CRD) Engine



With the introduction of the 2007 MY Y61 Patrol, the Diesel Engine range has now been revised with the introduction of the ZD30DDTi CRD Engine. This new Engine is now the only Diesel Engine option available for Y61 wagon & cab chassis variants. The TD42Ti engine has been discontinued as it does not comply to strict new ADR 79/01 (Euro IV) emission standards.

Transmission options for the new ZD30 engine in Y61 is either 5 M/T or 4 E-A/T which have been carried over from the previous models.

All Y61 ZD30 wagon variants are now fitted with ASCD (Cruise Control) as standard.

## ENGINE MECHANICAL - EM

### YD & ZD Engine Comparison Chart

|   | YD25DDTi (R51 & D40)<br>(Non DPF engine)                       | ZD30DDTi VP44 (Y61)  | ZD30DDTi CRD (Y61)   |
|---|--|--|--|
| <b>Cylinder Arrangement</b>                     | Inline 4 Cylinder  | Inline 4 Cylinder  | Inline 4 Cylinder  |
| <b>Displacement (cc)</b>                        | 2488   | 2953   | 2953   |
| <b>Bore &amp; Stroke (mm)</b>                   | 89.0 x 100   | 93.0 x 102.0   | 93.0 x 102.0   |
| <b>Compression Ratio</b>                        | 16.5 : 1   | 17.9 : 1   | 17.9 : 1   |
| <b>Firing Order</b>                             | 1-3-4-2  | 1-3-4-2  | 1-3-4-2  |
| <b>Cylinder head</b>                            | Alloy, cross flow  | Alloy, cross flow,   | Alloy, cross flow,   |
| <b>Air Intake system</b>                        | Vacuum operated Air Intake Control valve.<br>(No swirl valves) | Vacuum operated Air Intake Control valve.<br>Swirl valves utilised | Electrically operated Air Intake Control valve.<br>Swirl valves utilised |
| <b>Valve gear &amp; drive system</b>            | DOHC, 16 Valve, shim adjustable. All chain driven              | DOHC, 16 Valve, shim adjustable. Combination of gear & chain drive | DOHC, 16 Valve, shim adjustable. Combination of gear & chain drive       |
| <b>Injection</b>                                | Direct – HP Common Rail (1800 Bar DENSO)                       | Direct – HP Radial type pump (Bosch VP44 )                         | Direct – HP Common Rail (1600 Bar BOSCH)                                 |
| <b>Cylinder Block</b>                           | Cast Iron, 1 piece   | Cast iron, 2 piece   | Cast iron, 2 piece   |
| <b>Power (kW / rpm) &amp; Torque (Nm / rpm)</b> | 128 / 4000 & 403 / 2000  | 116 / 3600 & 352 / 2000 (*4) (*5)                                  | MT; 118/3600 & AT; 118/3600<br>MT; 380/2000 & AT; 354/2000               |
| <b>Balance Shafts</b>                           | Separate Unit located in sump, gear driven                     | Integrated into Engine Block, gear driven                          | Integrated into Engine Block, gear driven                                |
| <b>VNT Turbo &amp; Intercooler</b>              | Yes & Yes  | Yes & Yes (*4)   | Yes & Yes  |
| <b>Engine Oil Pressure detection system</b>     | Standard single switch system                                  | Dual switch system (*3, *4) (HP & LP switches)                     | OP sensor & separate OP switch system                                    |
| <b>Engine Oil Level detection system</b>        | Electronic. Oil Level Gauge to manually inspect also           | Oil Level Gauge to manually inspect only                           | Oil Level Gauge to manually inspect only                                 |
| <b>Engine Oil Maint. Intervals (km's)</b>       | 10,000   | 10,000   | 10,000   |
| <b>Engine Oil Specification</b>                 | ACEA B3 10W40 (*1)<br>Do <u>NOT</u> use in DPF models.         | ACEA B3 10W40 (*2)   | ACEA B3 10W40 (*2)   |

(\*1) REFER TO STB MA 05-001. (\*2) REFER TO STB MA 04-001. (\*3) REFER TO STB's EC 06-002a, EC 05-006, EC 03-006.

(\*4) Not D22 models (\*5) Increase in power & torque, different specs between A/T & M/T on Ser IV, figures not shown.



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ZD30DDTi CRD Engine

Nissan Australia July 2008

## ENGINE MECHANICAL - EM

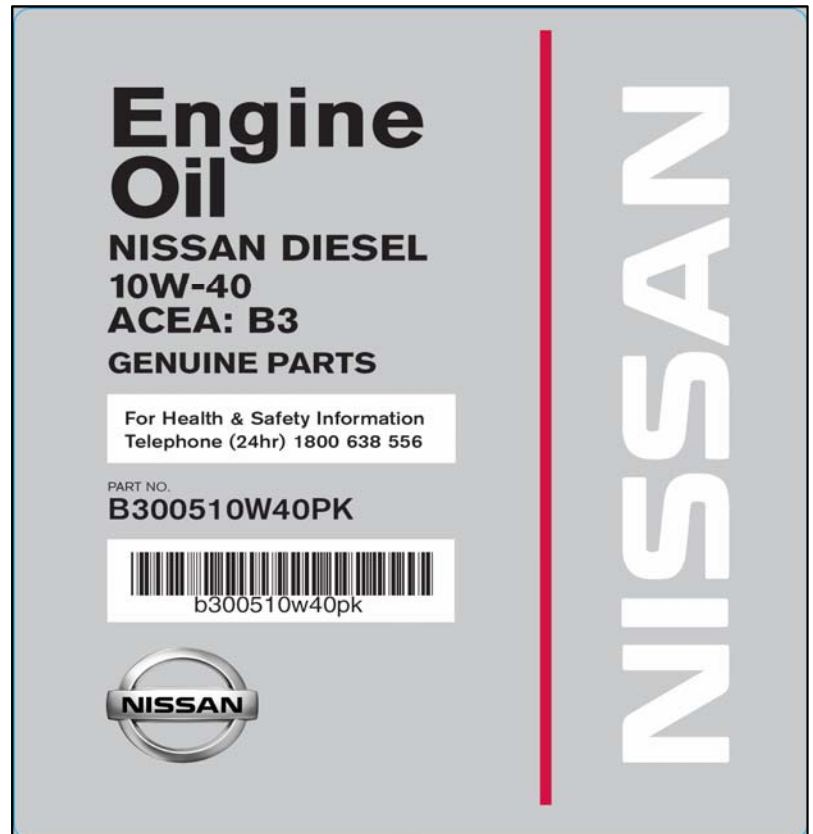
### ZD30DDTi Engine Oil

Only use a 10W 40 ACEA B3 engine oil in ALL ZD30 ENGINES! (Non CRD as well as CRD ZD30 since the year 2000)

The Engine Oil & Filter is to be replaced after a MAXIMUM of 10,000km's or 6 months. More frequently is the vehicle is operated under harsh conditions.

#### NOTE:

This is the Engine Oil recommended for ALL NON DPF YD25 engines.



**ONLY USE THIS ENGINE OIL (or equivalent) IN ALL ZD30 ENGINES PRODUCED SINCE THE YEAR 2000.**

**ONLY USE THIS ENGINE OIL IN ALL (non DPF) YD25 ENGINES**

### ENGINE MECHANICAL - EM

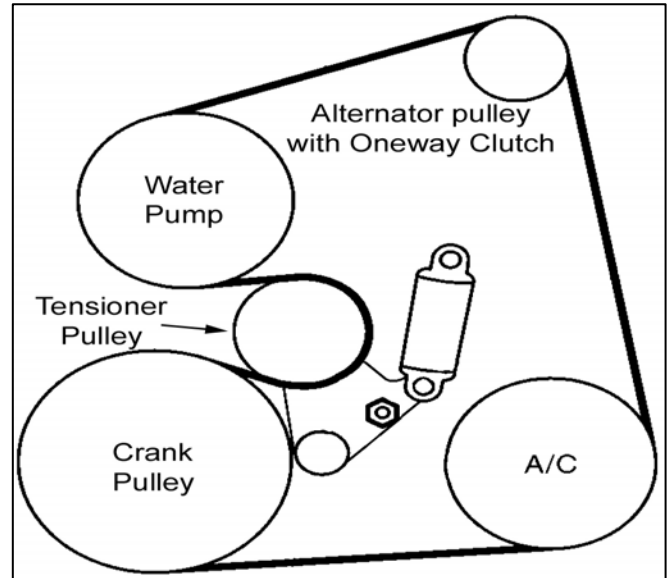
#### ZD30DDTi Drive Belt

The Single serpentine type drive belt has been carried over from the previous engine.

The belt tension is self adjusting due the Auto hydraulic tensioner unit & the alternator utilises a one way clutch in order to stop belt squeak noise when the engine decelerates.

The Power Steering pump is mechanically driven by the engine on all ZD30 engines.

Reference should be made to section EM of the Service Manual for details on removal, installation & inspection of the belt.



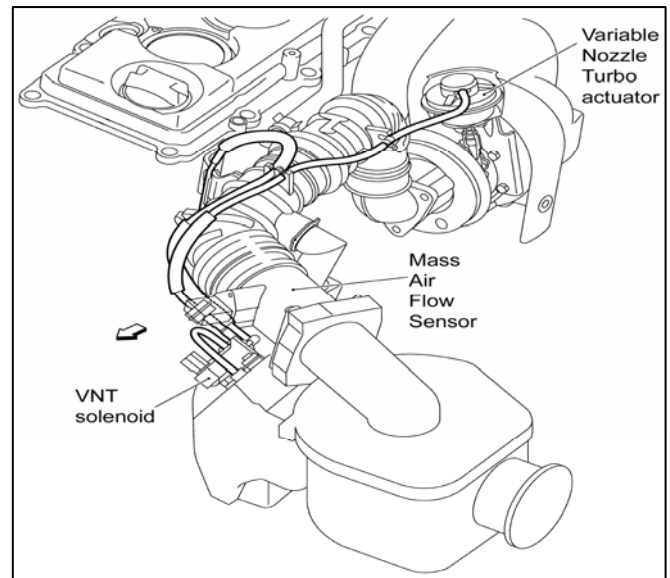
#### ZD30DDTi Air Cleaner & Intake

The Air Filter Element is a **VISCOUS PAPER TYPE**.

It has been carried over from previous models.

**DO NOT REMOVE DIRT FROM THE ELEMENT WITH COMPRESSED AIR!**

Pay careful attention to the installation of the Air Cleaner element. Please ensure that there is no leakage of dust. If detected check the seal & paper of the element, if the seal or paper is damaged replace the element immediately.

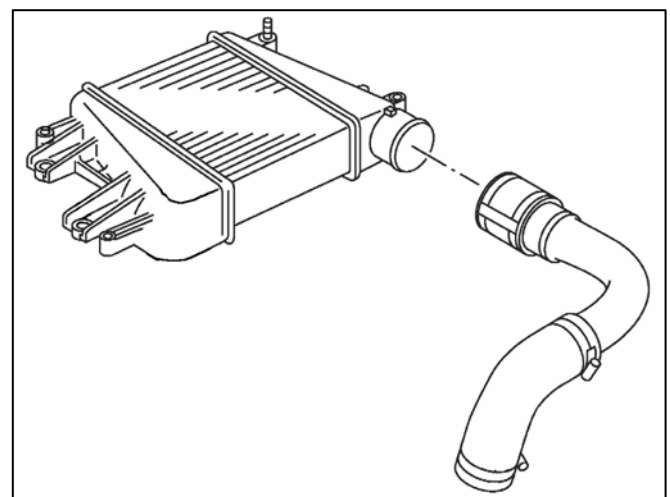


#### ZD30DDTi Charge Air Cooler

The Charge Air Cooler (Intercooler) continues to be horizontally mounted over the top of the engine as it was in previous models. The air outlet of the cooler has changed due to the change of intake manifold configuration.

Special attention should be paid to section EM of the Service Manual regarding any work involved with the Charge Air Cooler system.

**PLEASE ENSURE THAT ALL FITTINGS ARE SECURE & FREE FROM AIR LEAKAGE.**



### ENGINE MECHANICAL - EM

#### ZD30DDTi Intake Manifold

The Intake Manifold as shown right is mounted on the RH side of the Cylinder Head.

An electrically operated Air Intake Control Valve is utilised & the Swirl Valves have been incorporated inside the intake manifold.

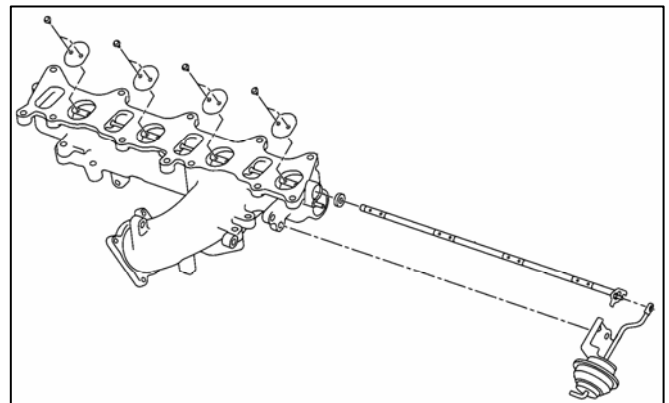
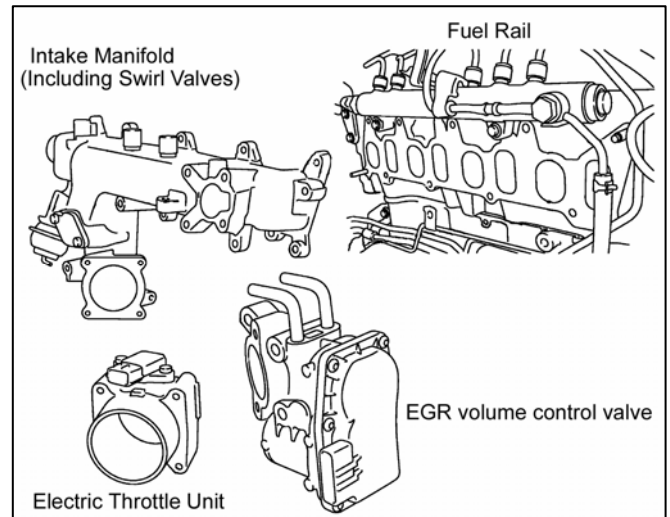
#### Electric Throttle Control Actuator;

On the previous ZD engine as well as the non DPF YD25 engine, the Air Intake Control valve was vacuum controlled. Now on the new ZD30 CRD engine, the valve has the same purpose as previous, however it is electrically operated. Its operation is very much the same as a ETC unit found on many petrol engines.

The Throttle valve is fully opened when the engine is running. The valve is closed only to perform smooth engine stop when the ignition switch is turned OFF. A feedback sensor (Throttle Position Sensor – TPS) is also installed to ensure the ECM can detect the throttle plates position.

#### (Vacuum operated) Swirl Valves;

The swirl control valve is installed inside the manifold assembly. While idling and during low engine speed operation, the swirl control valve closes, thus the velocity of the air in the intake passage increases to produce a swirl (rush of air to promote cleaner burning when the fuel is injected into the air) into the combustion chamber. Once the engine speed increases to a certain speed, the valves open to allow more air to enter the engine. Further information regarding the components shown right can be found in section EM & EC of the Service Manual.

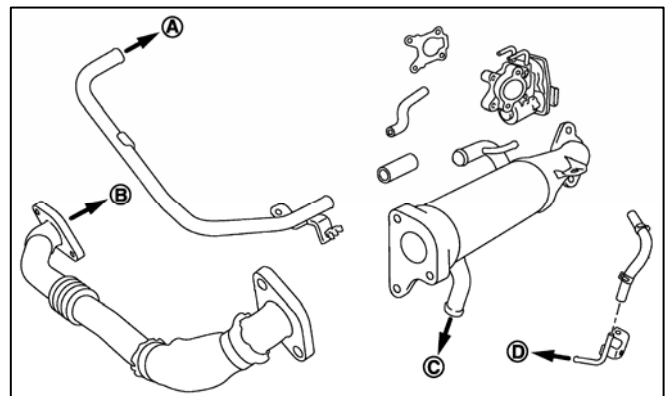


#### ZD30DDTi Exhaust Gas Recirculation (EGR) System

Major changes have occurred with the EGR system on the new ZD30 CRD engine.

The EGR volume control valve continues to be electrically controlled by the ECM, however it has a throttle valve arrangement & works in a similar way to an ETC unit found on current petrol engines.

The Pipe linking the exhaust manifold to the EGR control valve assembly is also water cooled as it is on R51 / D40 YD25 A/T models.



A, C, D: Engine Coolant

B: Exhaust Gases

Further information regarding the components shown right can be found in section EM & EC of the Service Manual.

### ENGINE MECHANICAL - EM

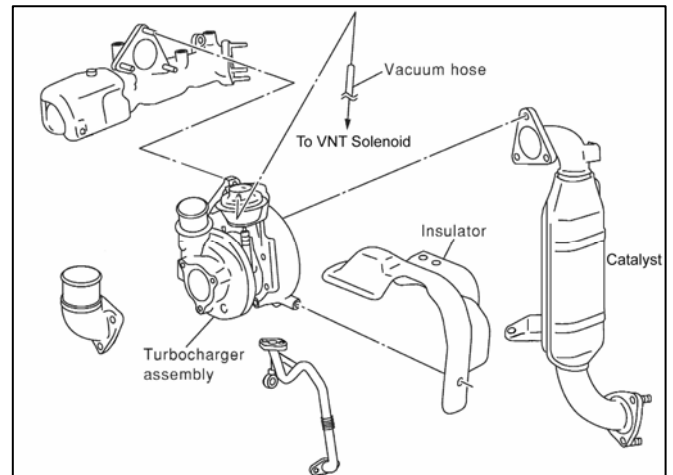
#### ZD30DDTi Exhaust Manifold, Turbo & Catalyst

The Exhaust Manifold system is similar to that fitted to the previous ZD engine on Y61.

A VNT type Turbo Charger unit continues to be utilised.

Special attention should be paid to section EM of the Service Manual regarding any work involved with the components shown right.

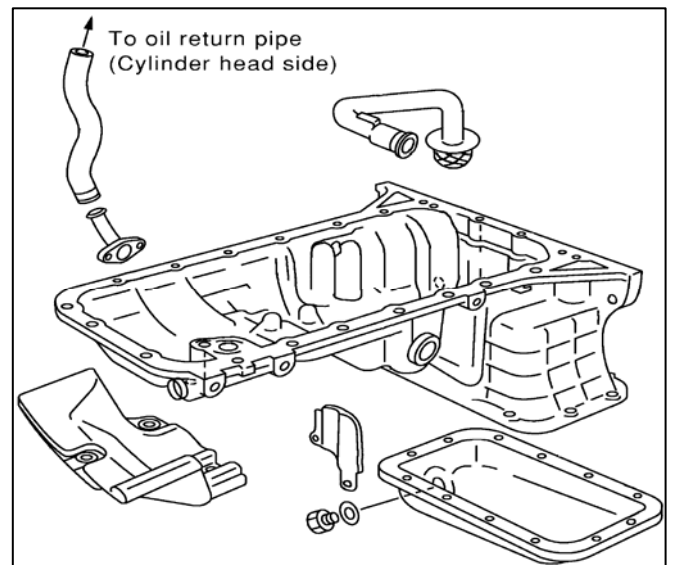
**Please ensure that the Engine Oil level is NOT overfull when diagnosing a complaint of Oil Leakage from the Turbo Unit.**



#### ZD30DDTi Oil Pan

The Oil Pan design is very much the same as that installed on the previous ZD Engine.

Further information regarding the components shown right can be found in sections EM of the Service Manual.

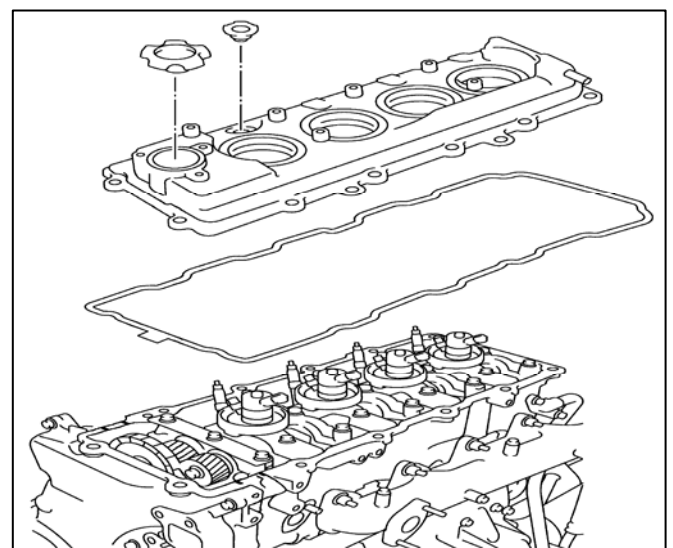


#### ZD30DDTi Rocker Cover

The Rocker Cover is now made from a resin material and the design has changed to allow the fitment of the new type of Injectors.

The injectors are electrically controlled & the wiring connectors protrude through the top of the Rocker Cover in a similar manner to the Injectors on the YD25 Engine.

Further information regarding the components shown right can be found in sections EM of the Service Manual.



### ENGINE MECHANICAL - EM

#### ZD30DDTi Glow Plugs

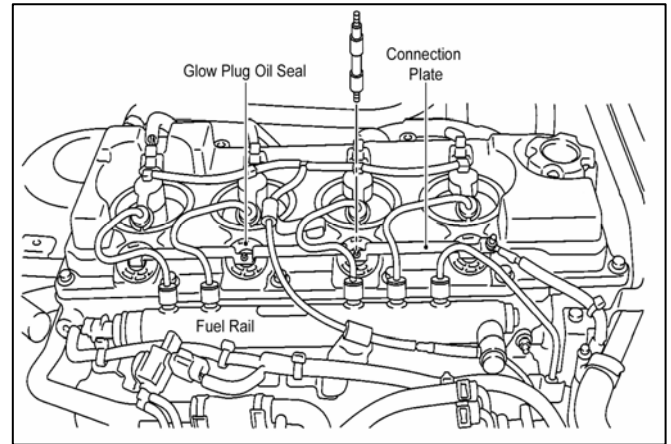
Once again the Glow system construction & operation is near identical to the previous ZD Engine.

It is necessary to remove the Glow Plugs in order to measure the Engine Compression.

**NOTE: The same SST adapter for measuring compression is carried over from the previous ZD30 engine. SST# ED19600620 or ED19600620AUS**

Refer to section EM of the Service Manual for more information on the removal process of the Glow Plugs as well as checking Engine Compression.

Section EC of the Service Manual discusses the operation of the Glow Plugs.

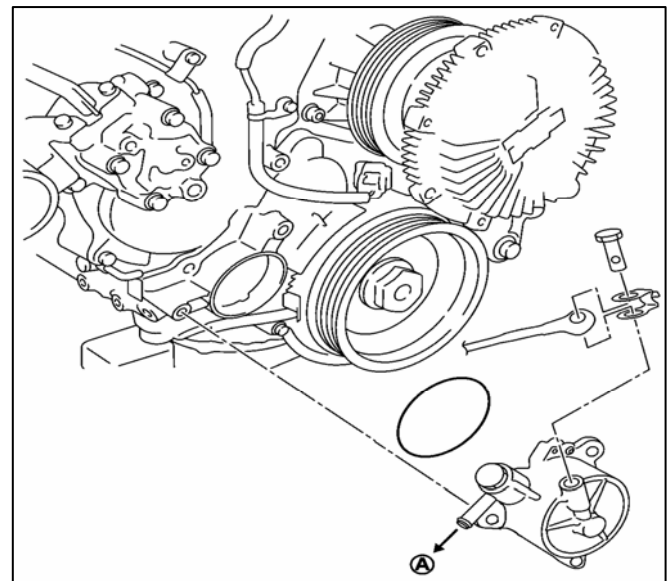


#### ZD30DDTi Vacuum Pump

The Vacuum Pump continues to be engine driven & is located on the RH side of the engine.

**NOTE:**

As part of a "Lack of Power" trouble diagnosis, ALWAYS ensure that the vacuum pump is functioning OK. If the vacuum pump is worn & it is not providing sufficient vacuum, the turbo will not operate properly. As a result the engine will lack power due to lack of Turbo Boost.



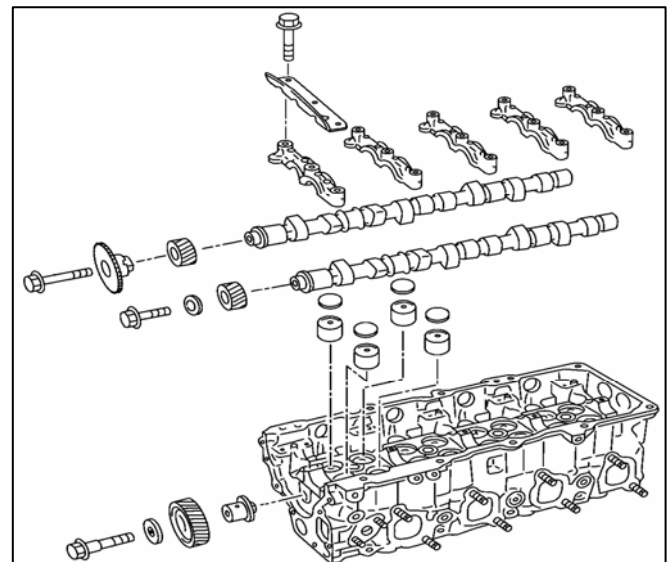
#### ZD30DDTi Camshafts & Cyl Head

The construction of the Cylinder Head is similar to that on the previous ZD Engine. However the Camshaft Signal Plate & sensor (CMPS) is located at the front of the head. (The previous ZD CMPS is located within the Injector Pump.)

The valves (like the previous ZD as well as the YD engine) are shim adjustable. However valve clearance adjustment is NOT required unless there is a problem. (See over page for more detail)

Refer to section EM of the Service Manual for more information on the components shown right.

Refer to **STB EM 04-002** for information regarding some pre CRD ZD30 engines that have a 1 piece valve lifter assembly. (No shims)



### ENGINE MECHANICAL - EM

#### ZD30DDTi Valve Clearance Adjustment “Shim Kit” Special Service Tool (SST)

Valve clearance checks are NOT a normal maintenance requirement for any ZD30 engine. However, (typically after an engine repair operation) there will be a need to check the valve clearance adjustment on ZD30 engines. (CRD & non CRD engines). If the clearance is incorrect, the adjustment operation is a matter of fitting a different thickness shim between the camshaft lobe & the valve lifter (bucket).

- If the clearance is too tight, the shim needs to be removed & a **thinner** shim is to be put in it's place.
- If the clearance is too loose, the shim needs to be removed & a **thicker** shim is to be put in it's place in order to tighten the clearance.

Nissan Australia have developed a Special Service Tool (SST# 13229 VB200A) to facilitate the shim exchanging operation. The valve clearance “Shim Kit”.

The shims removed from an engine due to an incorrect clearance are **STILL SERVICEABLE** (to be kept for use in another engine). Therefore **DO NOT** discard them.

Check the actual measurement of them with a micrometer & place them into the compartment of the kit which matches the measured size. Then select another shim of a different size which will correct the valve clearance issue.

Always ensure the micrometer in use is **CORRECTLY CALIBRATED**.

On average, shims of all sizes should always be available in the kit.

Re-order of the complete kit is available through National Parts. Use the SST # as the part #.

Refer to section EM – SDS of the Service Manual for individual shim part numbers.

Refer to section EM – “Valve clearance adjustment” of the Service Manual for the Valve clearance adjustment procedure. There is a slight difference in the procedure between CRD & non CRD engines. Refer to the appropriate Service Manual supplement dependant on the VIN.

Refer to **STB EM 06-003** for more detail about the shim kit.



To be used as a tool. **DO NOT SELL THE SHIMS.**

**13229 VB200A; Kit for ALL ZD30 engines. 2000 to current CRD engines. Issued 2006**

**13229 VB100A; Kit for ALL RD28 engines in Y61 only, 1998 ~ end 1999. Issued 1999. It is recommended to check the valve clearances in Y61 RD28 engines every 20,000km's.**

**RD28 engines in Y60 models (1994 ~ 1997) used hydraulic lifters. Adjustment is not possible.**

**These kits are designed to facilitate the SWAPPING of shims of one size to another in order to correct the valve clearance on a specific engine.**

**These kits are NOT designed to facilitate the selling of shims. Once the kits arrive at your dealership, they are to be placed in the care of the Workshop & used as a Special Service Tool (SST). Only labour is to be on-sold for a valve clearance adjustment operation. DO NOT allow the shims from the kit to be sold.**

**In the unlikely event that a specific size shim has been used up, (however the number of shims in the kit as a whole should NOT vary) simply re-order that shim via parts to placed in the kit. Part # references can be found in the lid of the kit box.**

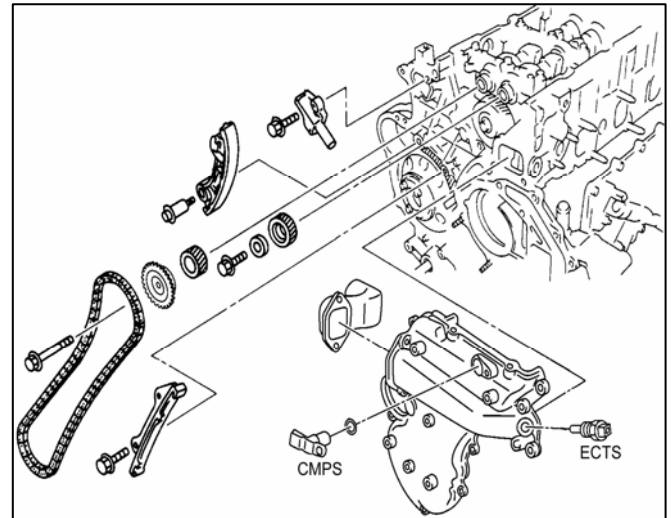
### ENGINE MECHANICAL - EM

#### ZD30DDTi Timing Chain

The mechanical timing system is configured as displayed in the diagram shown right.

As the case with the previous ZD engine, there is only 1 chain & it is driven by the sprocket attached to the Fuel Pump drive gear. The chain then drives a single sprocket which in turn drives the RH camshaft. The 2<sup>nd</sup> camshaft is driven via an idler gear.

Refer to section EM of the Service Manual for more information on the components shown right.



#### ZD30DDTi Timing Gears

The Timing Gear arrangement continues in the same format as the previous ZD30 engine.

The Fuel Pump removal procedure has been simplified. The pump needs to have 3 bolts removed from the rear. The Fuel Pump detaches from the engine **without** the need to remove timing gears etc.

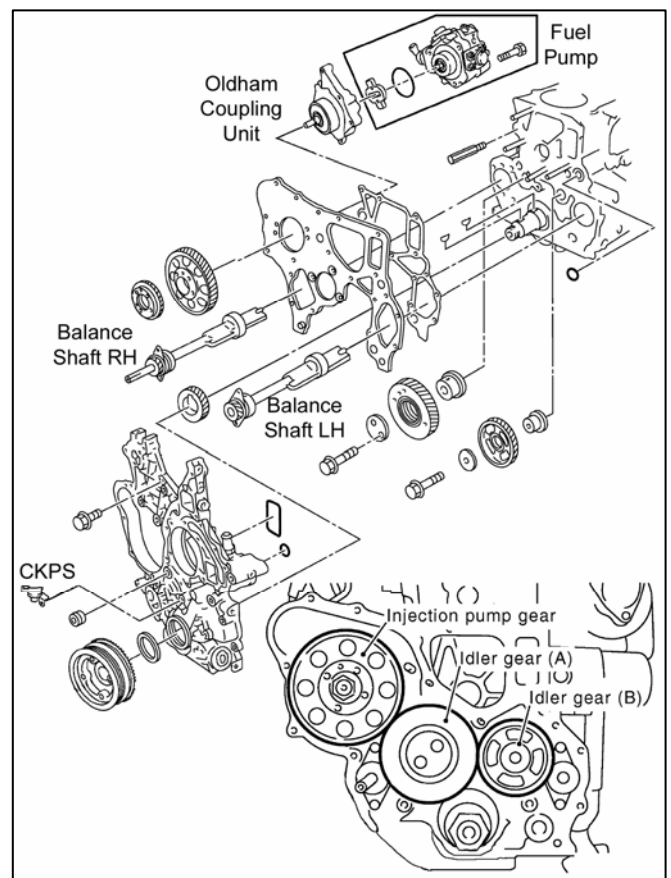
Refer to section EM of the Service Manual for more information on the components shown right.

Refer to Section EC of the Service Manual for information regarding the removal of the Fuel Pump.

**Special Notes for the removal of bolts etc. when dismantling the front section of the engine.**

1. None of the components (timing gears & chains etc.) in the diagrams shown right need to be removed for the Fuel Pump removal process on the new ZD30 CRD engine. Refer over page for more detail.

2. Please refer to **STB EM 04-005**. It clearly states that you must **NEVER** use an impact gun on any bolts that attach valve train gears etc. to the engine. Otherwise **SEVERE ENGINE DAMAGE WILL RESULT** and it will be at the **REPAIRERS EXPENSE!**

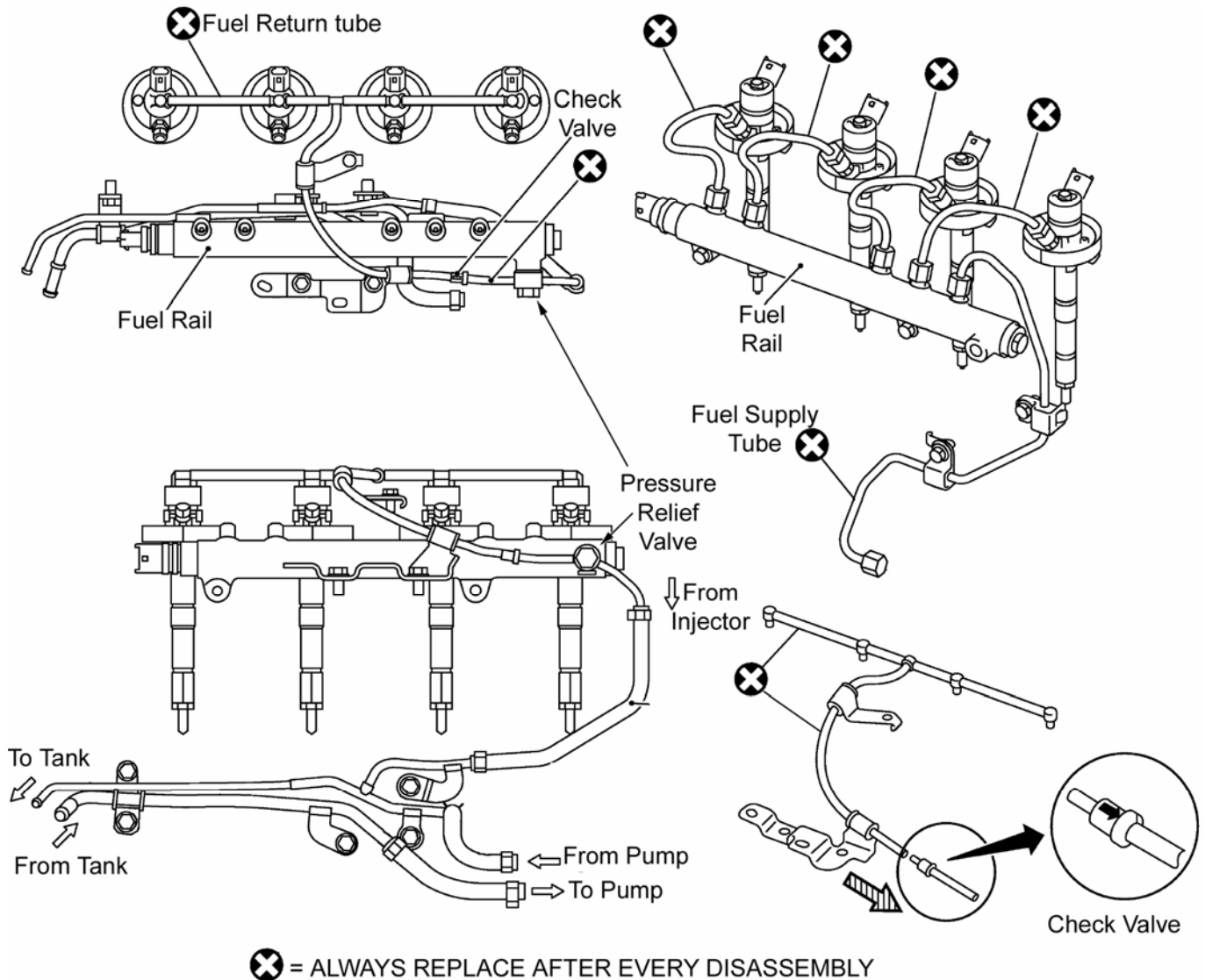


## ENGINE MECHANICAL - EM

### ZD30DDTi Fuel Rail, Pump & Injectors

The Common Rail along with the Injectors are mounted as shown in the diagram.

**TAKE NOTE** of the components that **CANNOT** be re-used once they have been removed or loosened.



**NEVER “CRACK OPEN” AN INJECTOR LINE WITH THE ENGINE RUNNING OR CRANKING.**

**Fuel pressure can reach a MAXIMUM PRESSURE of 1600 BAR (23,000PSI).**



## ENGINE MECHANICAL - EM

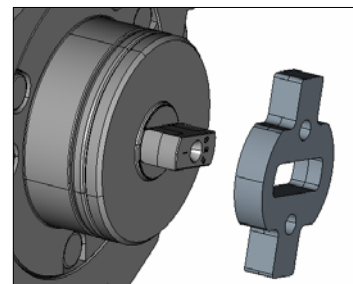
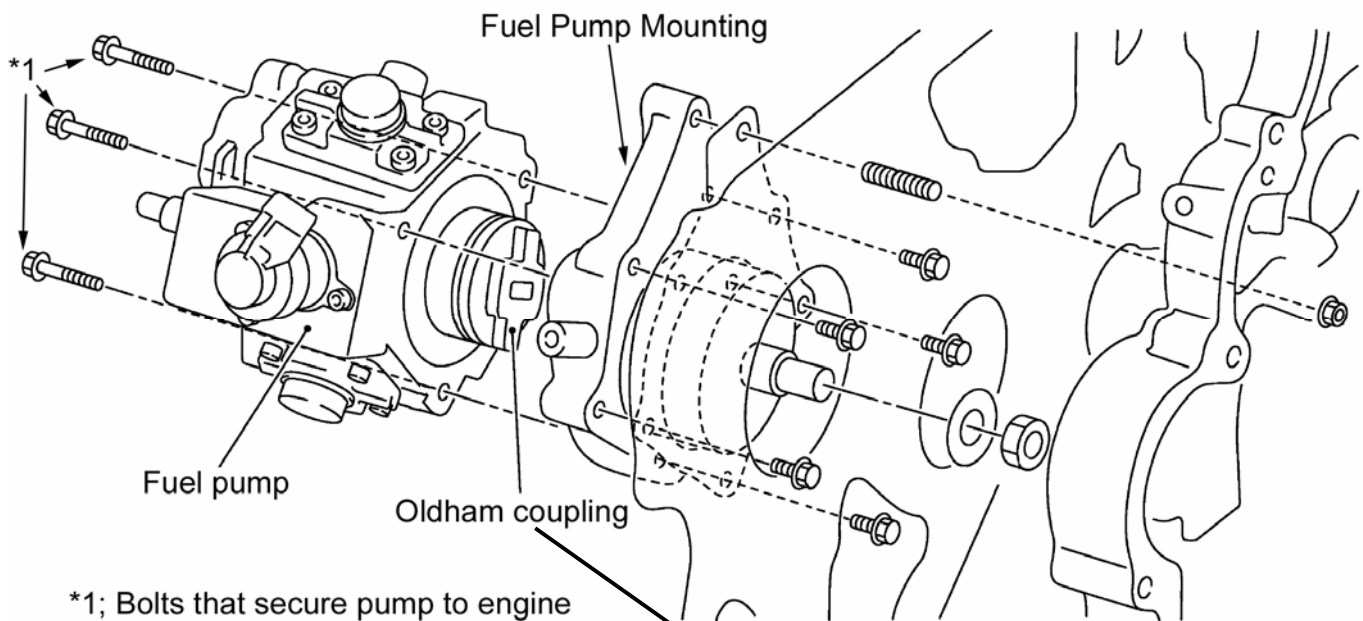
### ZD30DDTi Fuel Pump Removal

Refer to section EC of the Service Manual for the removing & re-installing the Fuel Pump procedure. The new pump is now much simpler to remove & re-install than the previous VP44 unit.

The procedure involves the disconnection of the fuel lines & electrical plug. The pump is attached to the engine with 3 x forward facing bolts. The pump simply detaches from the engine **without** the need to remove any timing gears etc.

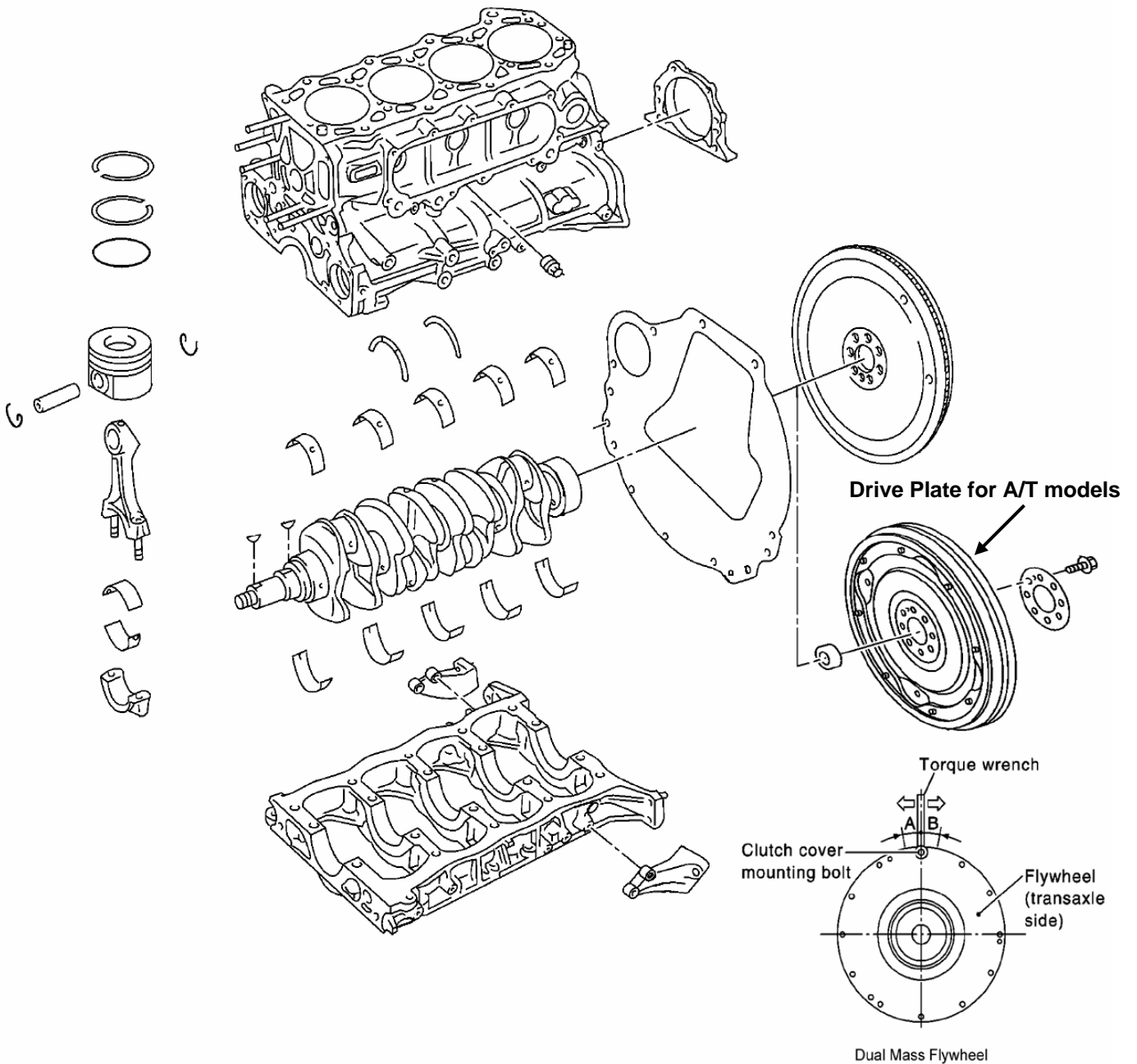
**NOTE:** When removing the Fuel Pump, there is **NO NEED** to remove the bolts located behind the pump drive gear. Only remove the bolts marked \*1 in the diagram and the pump is removed rearwards.

The other bolts shown attached the pump mounting / drive unit to the engine & they can only be accessed by 1<sup>st</sup> removing the front timing chain / gear cover & fuel pump drive gear.



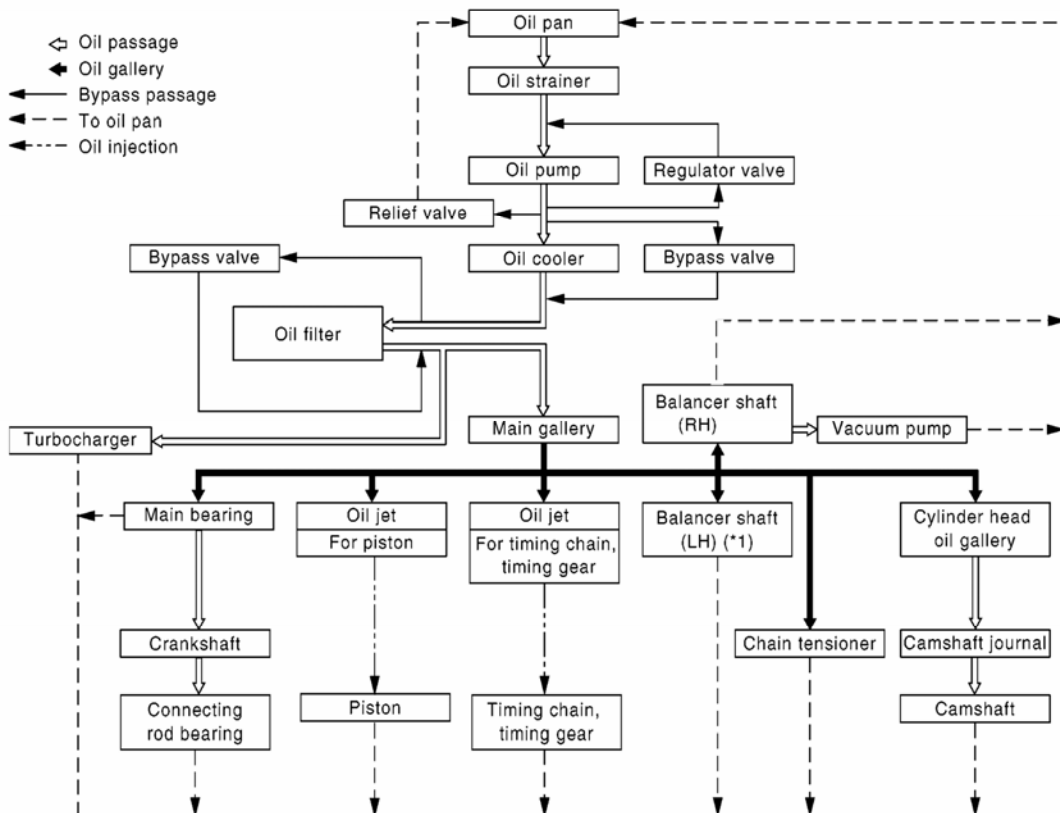
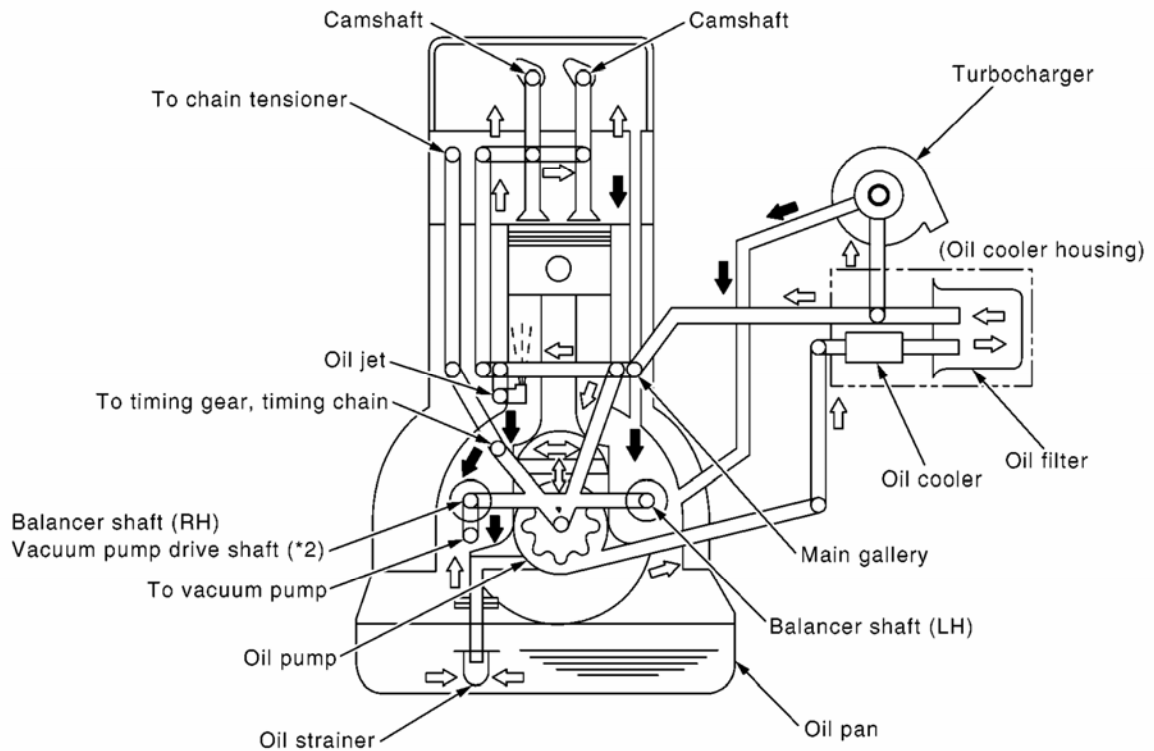
## ENGINE MECHANICAL - EM

### ZD30DDTi Cylinder Block & Dual Mass Flywheel (M/T)



## ENGINE LUBRICATION & COOLING SYSTEMS - LC

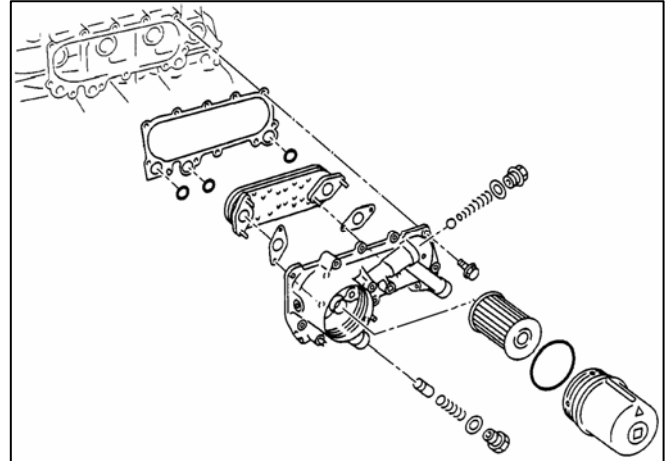
⇨ Feed  
⇩ Return



## ENGINE LUBRICATION & COOLING SYSTEMS - LC

### ZD30DDTi Engine Oil Filter & Cooler

The Oil Filter is located on the LH side of the engine towards the front. It is the same design as the previous ZD engine.



### ZD30DDTi Engine Oil Pump

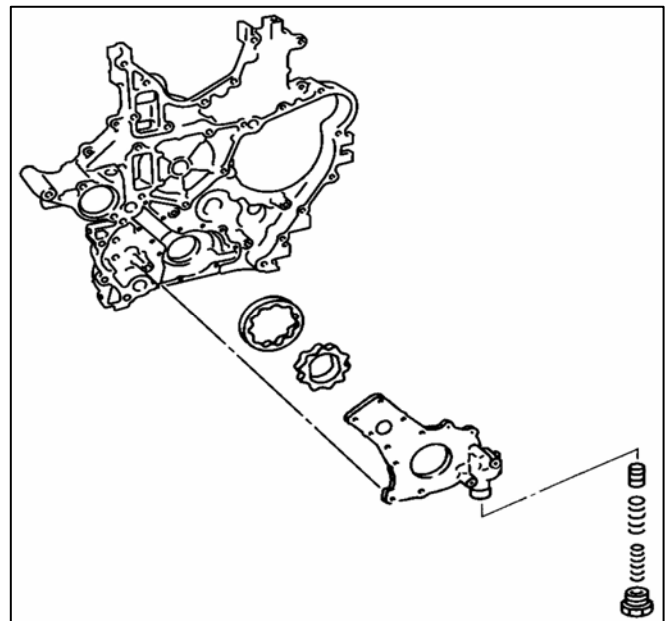
The Oil Pump is driven by the front of the crankshaft. The design of the pump is unchanged from the previous engine.

Oil Pressure is monitored via the ECM with the utilisation of an Oil Pressure **Sensor** which is located at the RH rear of the engine.

In addition to the Oil Pressure **Sensor** there is an Oil Pressure **Switch** located at the LH front of the engine, above the oil filter. This switch will ground & illuminate the 'red oil can' warning light when there is close to 0 Oil Pressure.

The above mentioned Oil Pressure **SENSOR** is connected directly to the ECM. If the ECM measures specific pressures at certain engine speeds & temperatures, the ECM will signal the Instrument Cluster to illuminate the RED OIL CAN warning light on the Instrument Cluster.

Refer to section EL of this Training Manual for more detail.



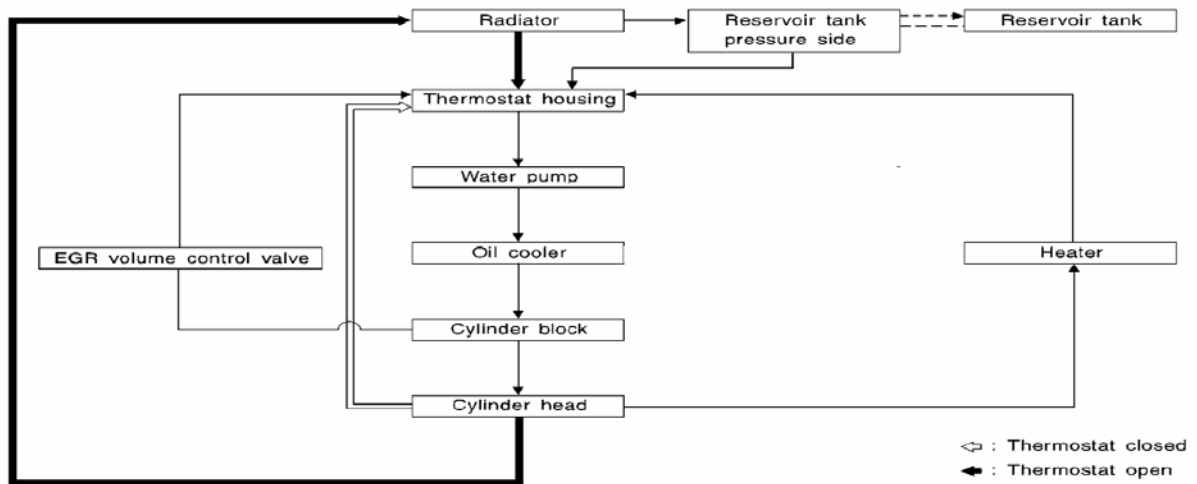
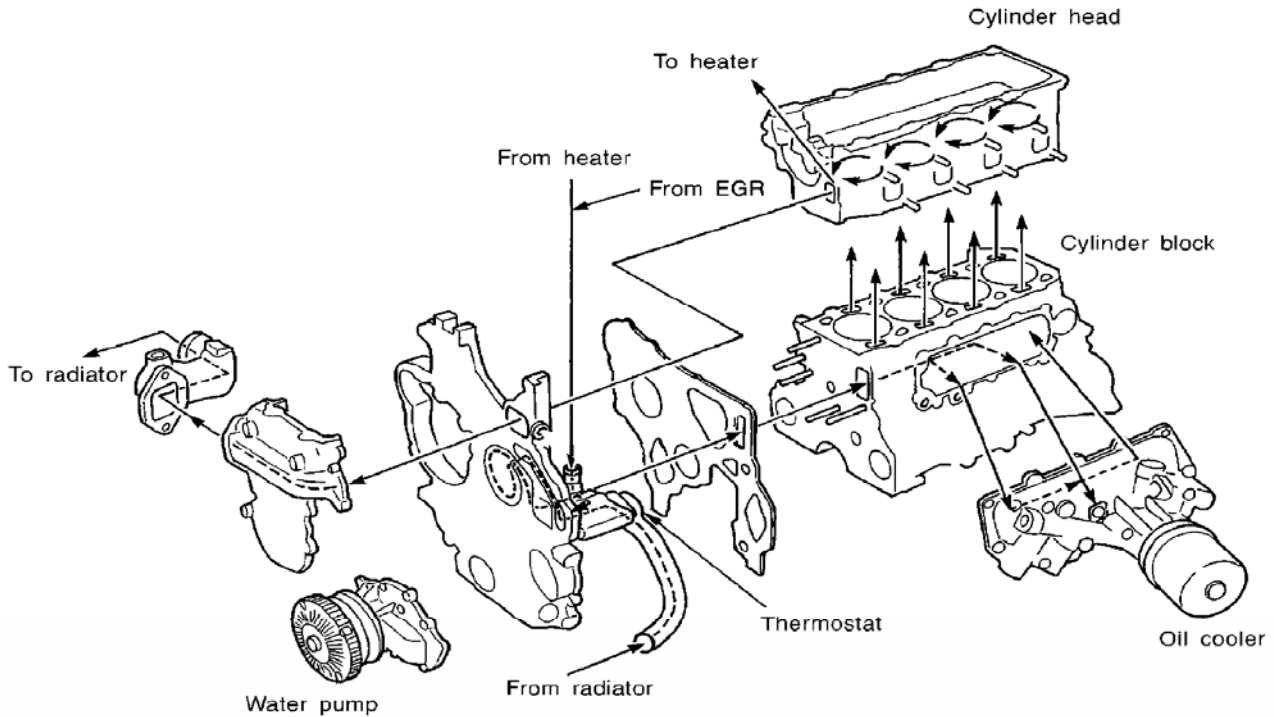
### ZD30 CRD Engine Oil Pressure Specifications.

Engine Oil Pressure measurements are to be taken from the RH Rear of the engine after the removal of the Oil Pressure **SENSOR**. **DO NOT** confuse the **Oil Pressure SENSOR** with the Oil Pressure Switch located on the LHF of the engine next to the Oil Filter.

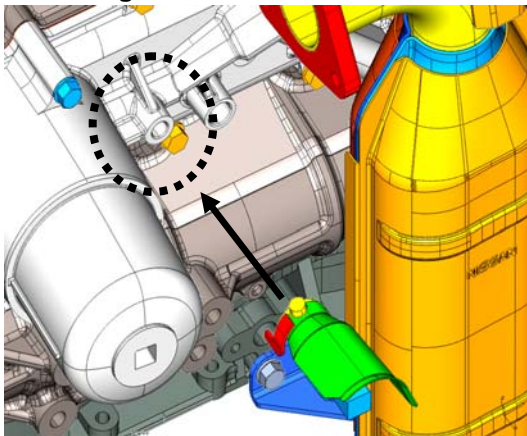
See over page for more detail of the Sensor & Switch locations.

| Engine speed<br>rpm | Approximate discharge pressure<br>kPa (bar, kg/cm <sup>2</sup> , psi) |
|---------------------|---|
| Idle speed          | More than 196 (2.0, 2.0, 28)  |
| 2,000               | More than 392 (3.9, 4.0, 57)  |
| 3,300               | More than 635 (6.4, 6.5, 92)  |

## ENGINE LUBRICATION & COOLING SYSTEMS - LC

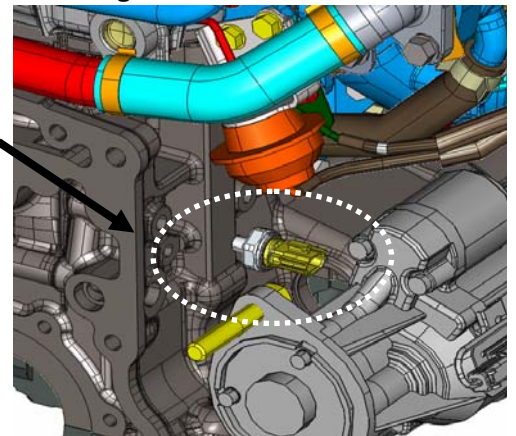


Engine Oil Pressure SWITCH



Only EVER attach an Oil Pressure gauge to this point if actual Engine Oil Pressure measurements are to be taken.

Engine Oil Pressure SENSOR

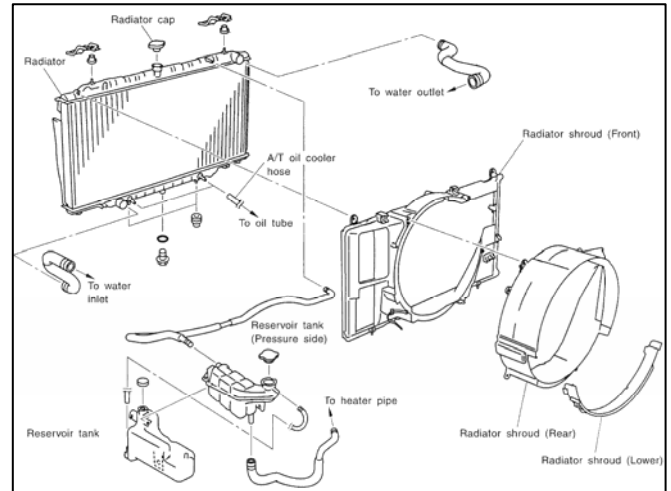


## ENGINE LUBRICATION & COOLING SYSTEMS - LC

### ZD30DDTi Radiator

The design of the Radiator has not changed from the previous design.

It is a down flow configuration & the system uses 1 x pressurised coolant reservoir & 1 x non pressurised coolant overflow tank.

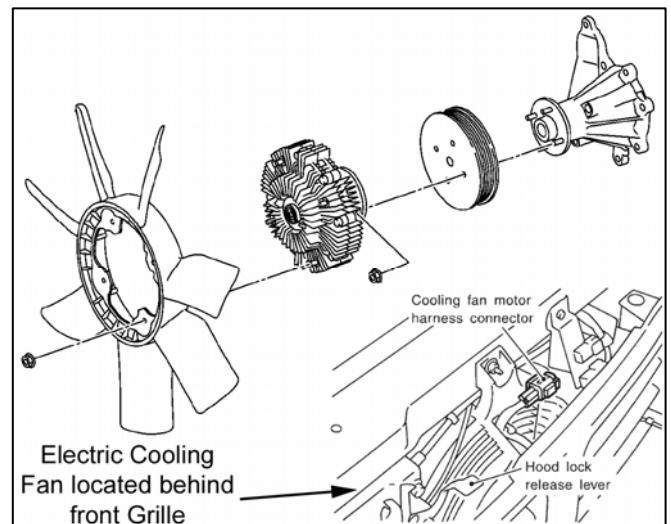


### ZD30DDTi Viscous Coupling & Electric Cooling Fans

The engine driven cooling fan has a temperature sensitive viscous coupling & is mounted on the Water Pump drive shaft.

The design differs from the previous ZD engine as the viscous coupling is now a separate part from the water pump.

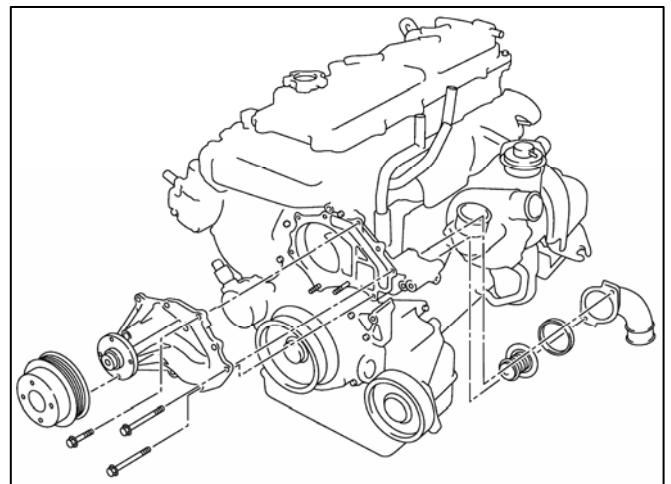
The electrically operated cooling fan is located in the same position as the electric fan on previous models. It's operation is via a relay which is controlled by the ECM.



### ZD30DDTi Water Pump & Thermostat

As mentioned above, the Water Pump & Viscous Fan Coupling are now separate parts. Otherwise the water pump design is unchanged.

The Thermostat is unchanged from the previous engine also.



## ENGINE LUBRICATION & COOLING SYSTEMS - LC

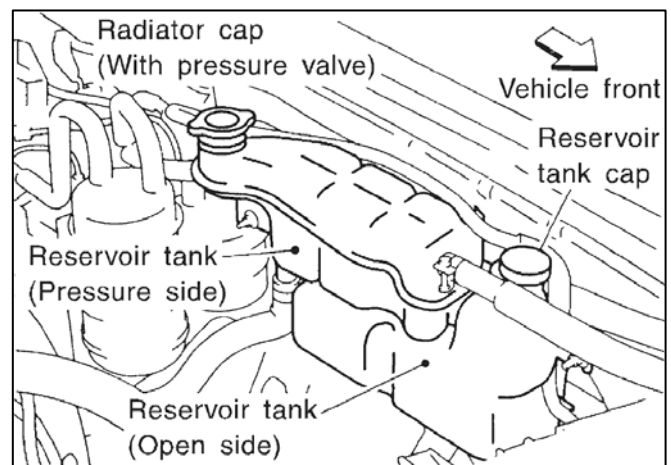
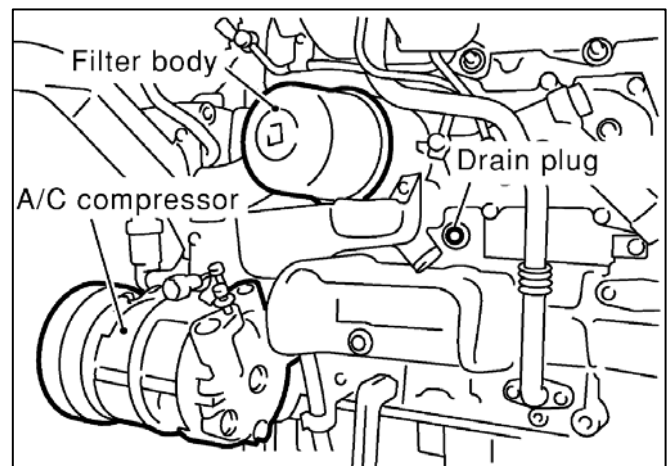
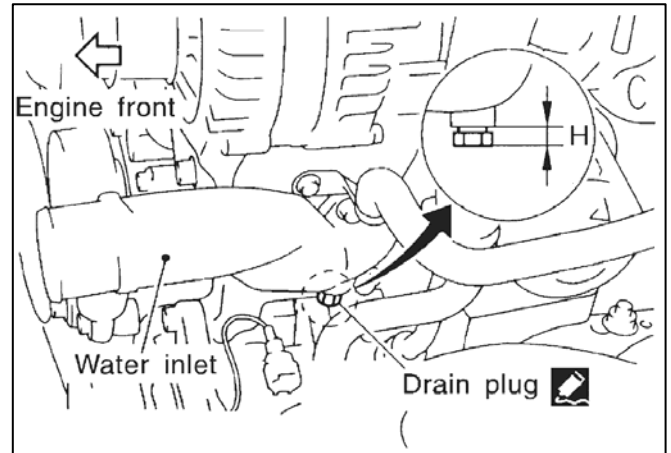
### ZD30DDTi Cooling System Maintenance

When the Coolant is to be changed please ensure the coolant is completely drained from the 2 x positions shown right.

As with ALL current Nissan models, the coolant is NOT to be changed until 80,000km's or 4 years (whichever comes 1<sup>st</sup>). Thereafter the coolant is to be changed every 40,000km's or 2 years.

When refilling, there is no specific bleeding point as the air will bleed itself out via the pressurised overflow tank.

Refer to section MA of the Service Manual for more detail.



## BOSCH COMMON RAIL DIESEL INJECTION

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### Basic Design Features of CRD

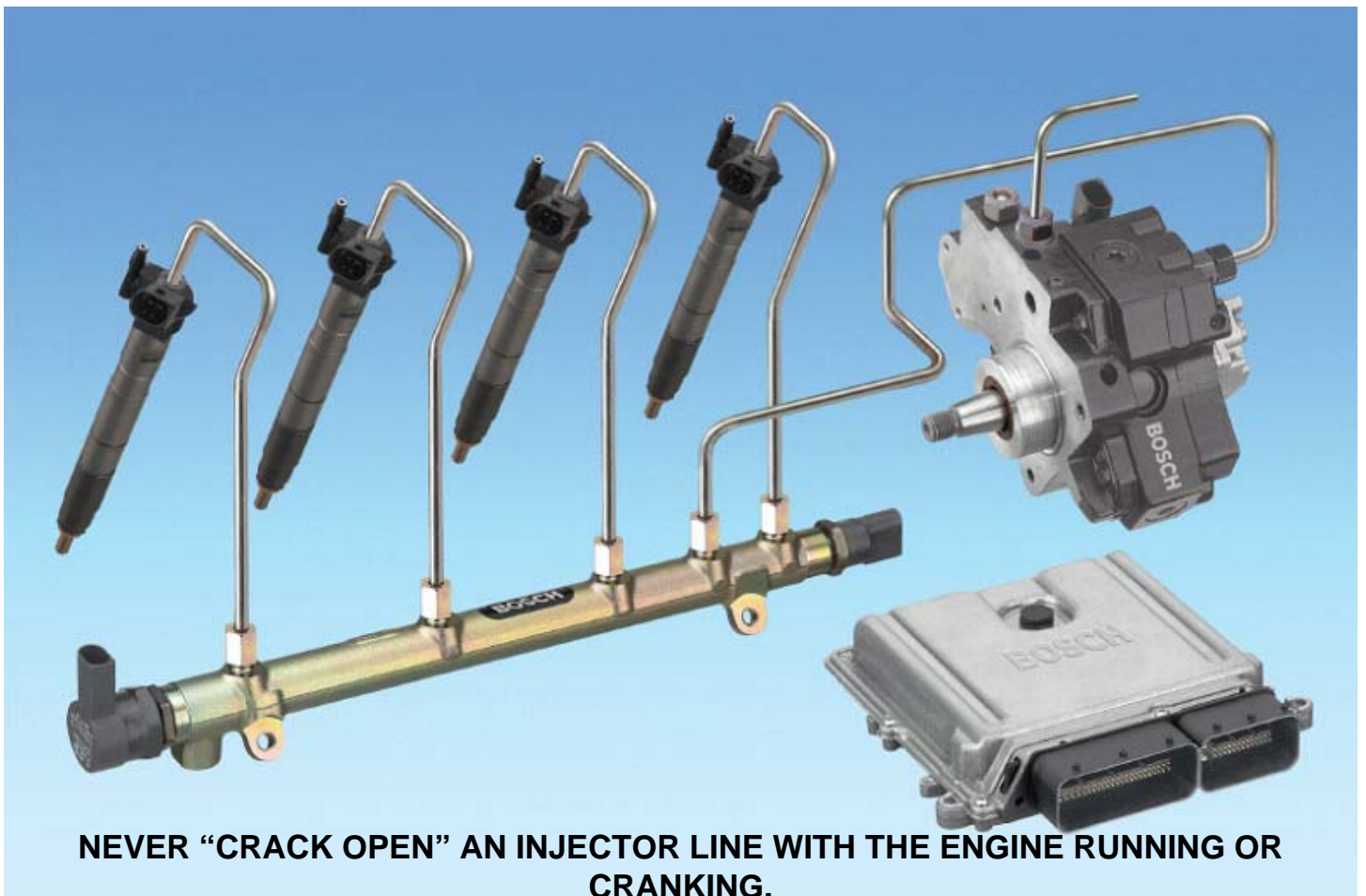
There is a chamber which is similar in appearance to a Petrol Engine EFI Fuel Rail mounted along the top of the Engine (i.e: the Fuel Rail or otherwise known as the "Common Rail")

The Rail is filled with fuel via a High Pressure Pump being driven directly by the engine. The design principle & operation is near identical to that of a Petrol Engine with EFI.

**NOTE:** Fuel Pressure is NOT created via Engine Oil Pressure as it is in some other types of CRD engines. This system is known as Hydraulic Electric Unit Injection – **HEUI**.

The Fuel is maintained under this extremely high pressure in the rail as so desired by the ECM. Steel tubes connected to each injector supply this pressurised fuel from the rail.

The injectors therefore can be operated by the ECM at any time to produce the very fine spray pattern (thanks to the readily available - at all times - high fuel pressure) in order to promote clean combustion.



**NEVER "CRACK OPEN" AN INJECTOR LINE WITH THE ENGINE RUNNING OR CRANKING.**

**Fuel pressure can reach a MAXIMUM PRESSURE of 1600 BAR (23,000PSI).**



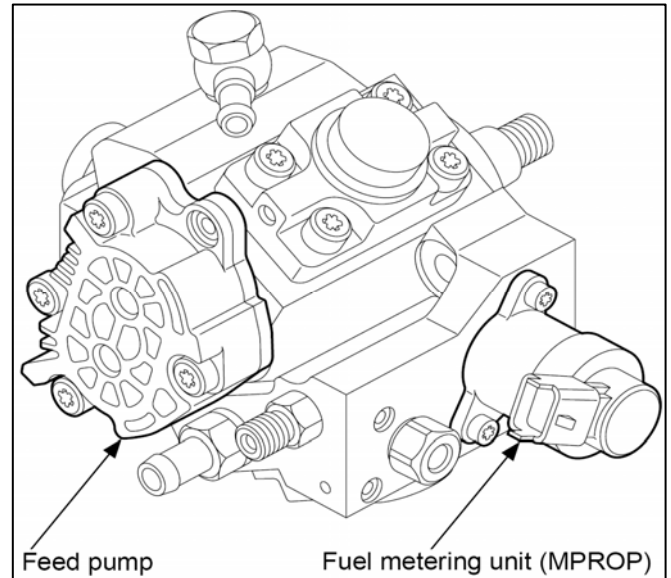
## BOSCH COMMON RAIL DIESEL INJECTION

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### 1. Fuel Pump (BOSCH CP1H)

The supply pump consists primarily of the following;

- Feed pump
- Fuel Metering Unit (MPROP - Metering Proportional Valve)
- High Pressure Pump

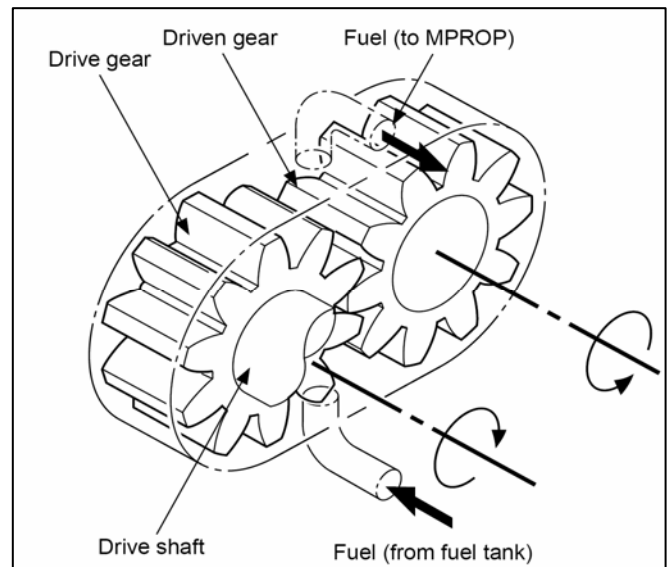


#### (i) Feed Pump

The feed pump is a circumscribed gear type pump and consists of a drive gear and a driven gear.

The drive gear is connected to the high-pressure pump drive shaft by a plate coupling.

The rotational speed of the drive gear is the same as that of the drive shaft.



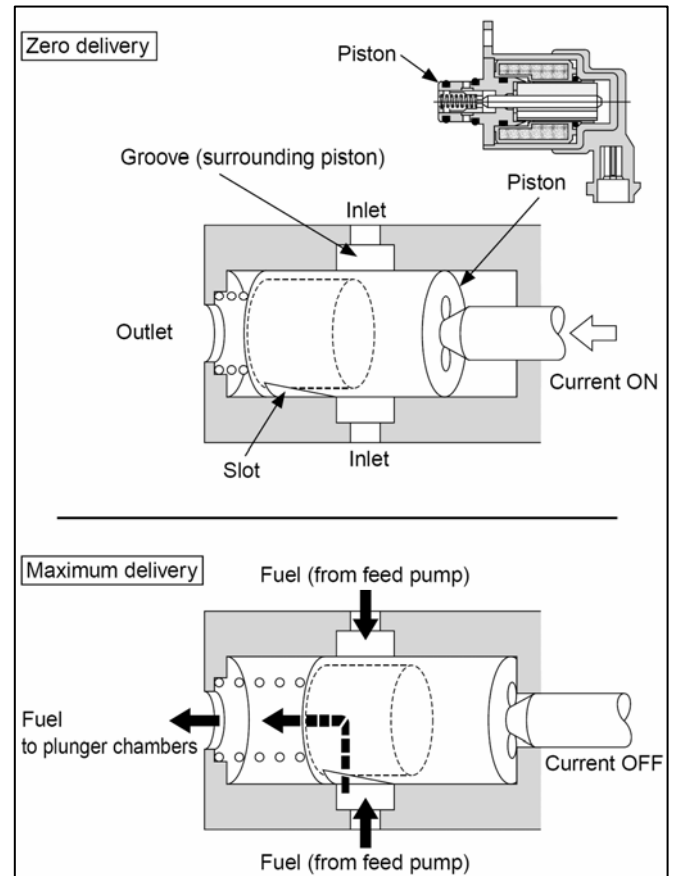
## BOSCH COMMON RAIL DIESEL INJECTION

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### 1. Fuel Pump (BOSCH CP1H) .../Cont'd (ii) Fuel Metering Unit (MPROP)

The fuel metering unit consists of a housing, an armature assembly, a magnetic core, a solenoid core, a piston and a spring.

The piston is located inside the magnetic core. Fuel flows through the inlets and into a groove running around the inside of the magnetic core.



## BOSCH COMMON RAIL DIESEL INJECTION

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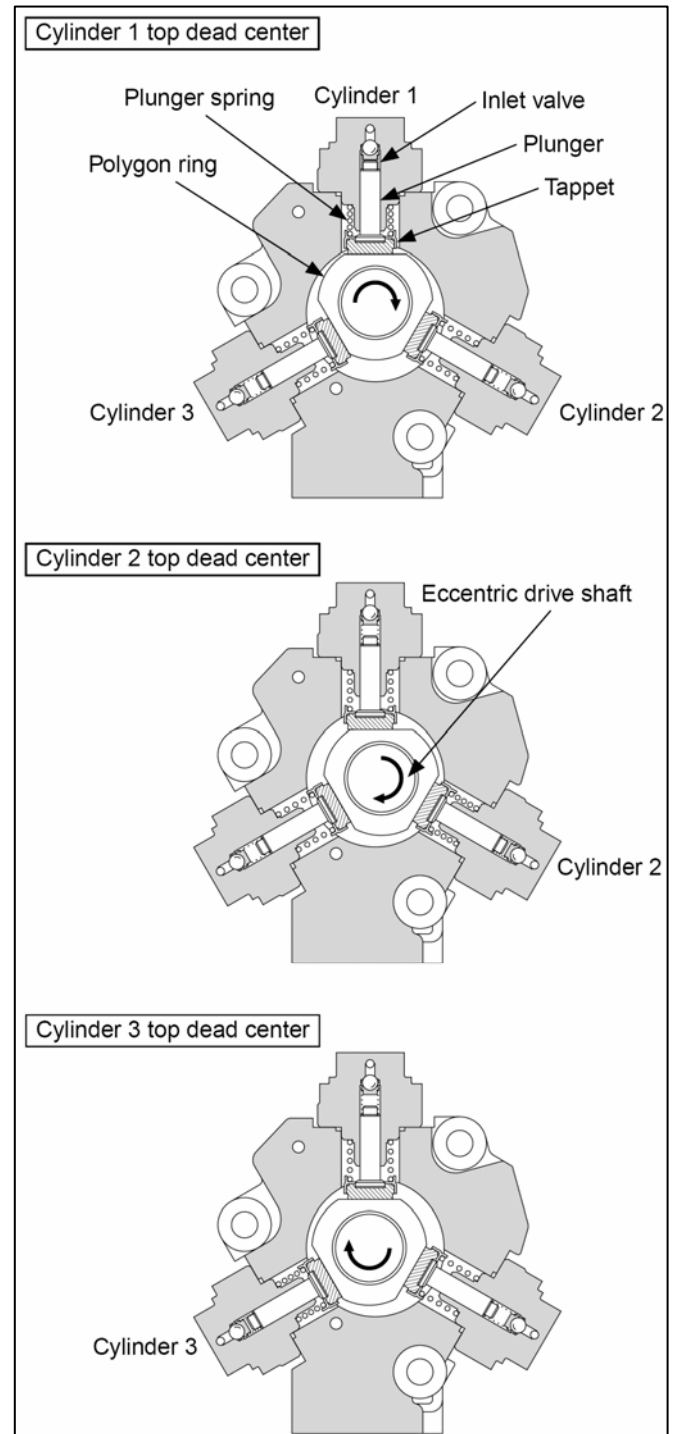
### 1. Fuel Pump (BOSCH CP1H) .../Cont'd (iii) High Pressure Pump

The high-pressure pump is a radial piston high pressure pump in which three plungers are arranged radially around the eccentric drive shaft.

The plungers are reciprocated by the eccentric rotation of the polygon ring assembled on the drive shaft. (The polygon ring itself does not rotate; it is only moved in a circular motion.)

The drive shaft is driven directly by the engine via a coupling.

The high-pressure pump consists of inlet valves, outlet valves, plungers, plunger springs, tappets, a polygon ring, a drive shaft and a pump housing.



## BOSCH COMMON RAIL DIESEL INJECTION

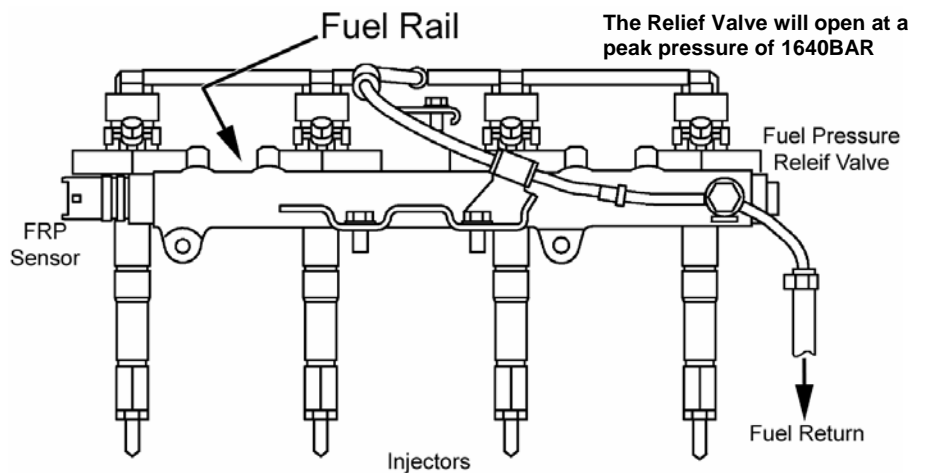
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### 2. Rail (BOSCH)

The Rail stores pressurised fuel (0 to 1600 BAR, 23,000psi) delivered from the supply pump and distributes the fuel to each cylinder's injector.

**NEVER "CRACK OPEN" A FUEL LINE WITH THE ENGINE RUNNING OR CRANKING.  
SEVERE INJURY WILL BE A RESULT OF THIS ACTION!!!**

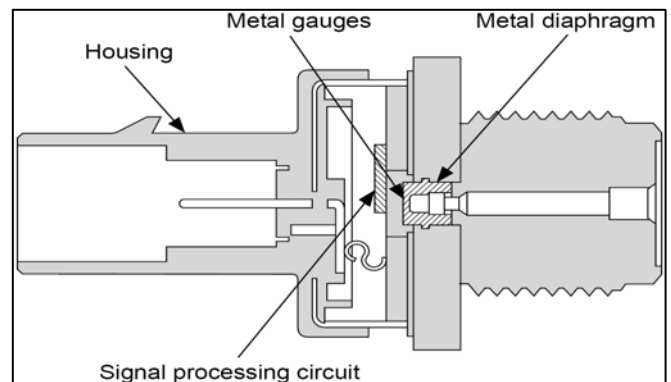
**PLEASE OBSERVE THE SAFETY  
PRECAUTIONS REGARDING HIGH  
FUEL PRESSURE SYSTEMS.  
REFER TO STB GI 05-007 FOR  
MORE DETAIL.**



#### (i) Fuel Rail Pressure Sensor (BOSCH)

The rail pressure sensor is mounted in the rear end of the rail and detects the fuel pressure in the rail. This signal is sent to the engine's ECU.

This sensor is a semi-conductor type pressure sensor which uses the Peizo resistive effect to detect changes in electrical resistance when pressure is applied to a silicon wafer.

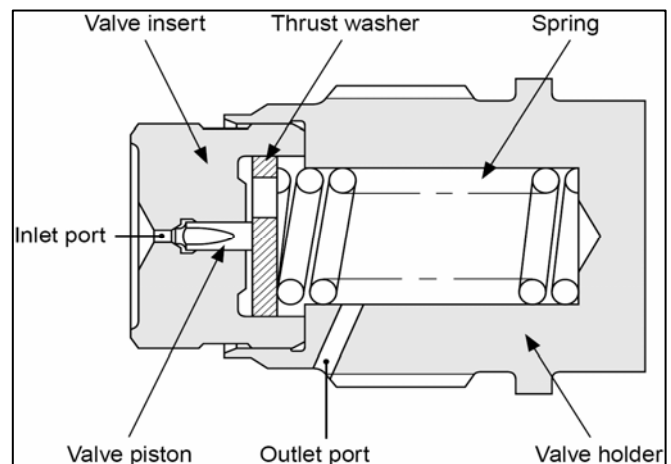


#### (ii) Pressure Limiting Valve (Fuel Pressure Relief Valve) (BOSCH)

The pressure limiting valve is a piston type seat valve. When abnormal pressure develops in the common rail, the pressure limiting valve returns fuel to the fuel tank to prevent an abnormal increase in pressure.

Once abnormal pressure develops, the valve piston opens and the overflow quantity is automatically adjusted to maintain a fixed fuel pressure in the rail and enable simplified vehicle running. Because this is an abnormal condition, it is then necessary to have the system inspected.

The valve will lift of its seat at a peak pressure of **1640 BAR.**



## BOSCH COMMON RAIL DIESEL INJECTION

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### 3. Fuel Injector (BOSCH)

In response to the signal from the ECU, the injector assembly supplies pressurized fuel from the common rail to the engine's combustion chamber at the optimum injection timing and the optimum injection quantity.

The injector assembly can be divided into the following two functional units;

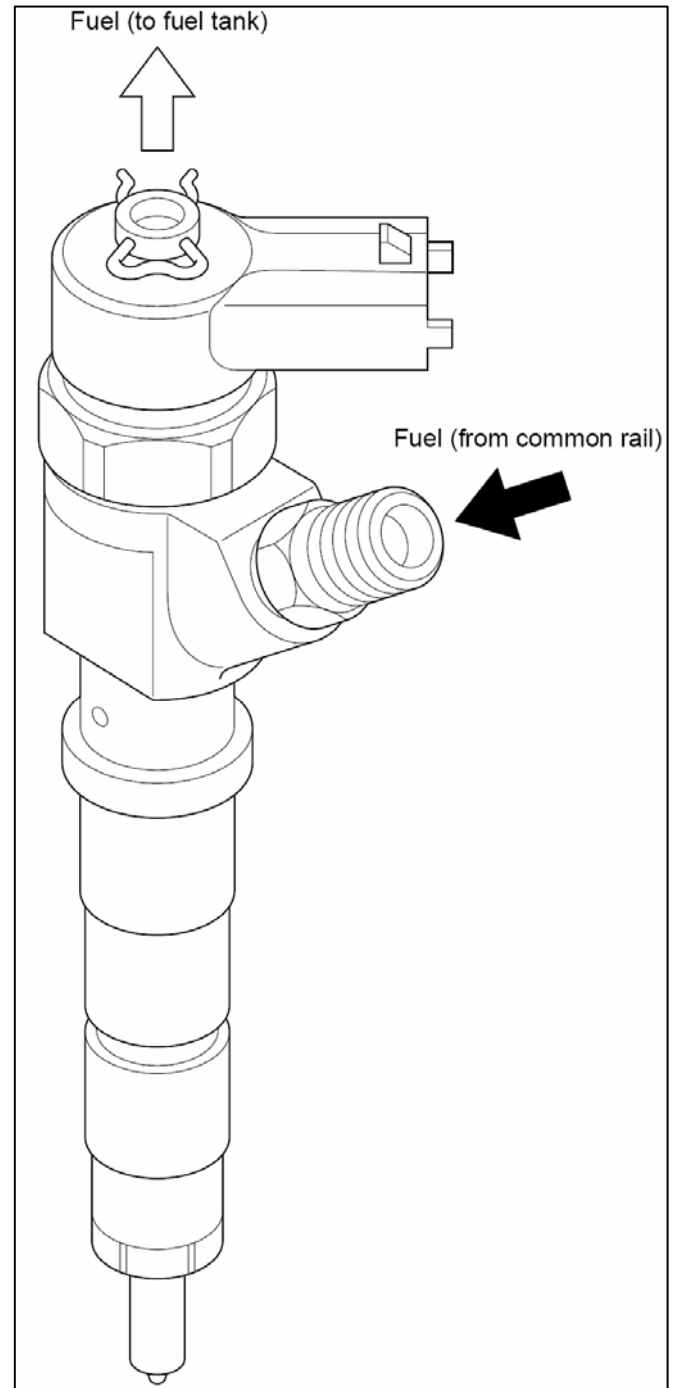
#### (i) Control section

The control section consists of a control chamber, a magnet, a valve spring, an armature plate, a valve ball, a valve body, a valve piston and 2 orifices.

A valve piston is located between the control section and the injector.

#### (ii) Injector

The injector consists of a nozzle body, a nozzle needle, a nozzle spring and a nozzle nut.



## BOSCH COMMON RAIL DIESEL INJECTION

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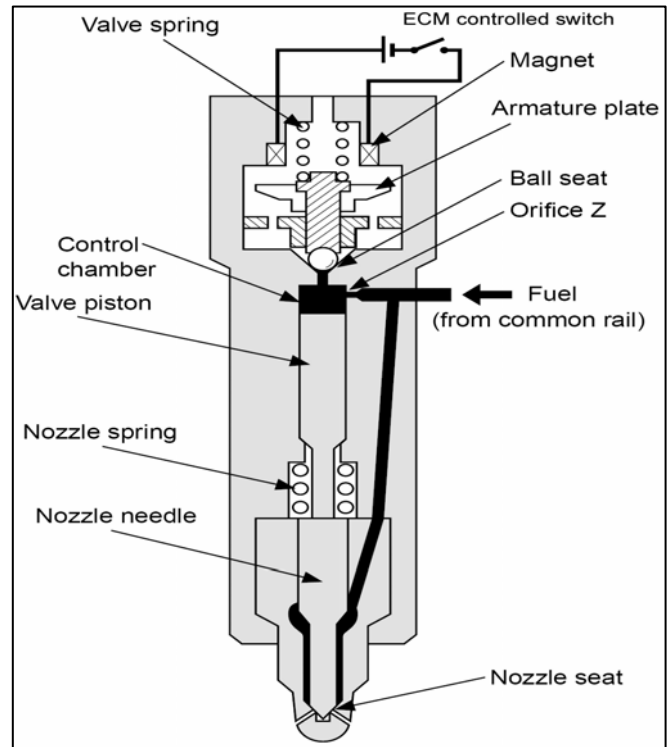
### 3. Fuel Injector (BOSCH) .../Cont'd Injector Operation;

#### (i) Non Injection

When the magnet is not energized, the armature plate is pushed down by the valve spring and the ball seat is closed.

High pressure fuel is acting on the control chamber through orifice Z. The same pressure also acts on the nozzle needle side.

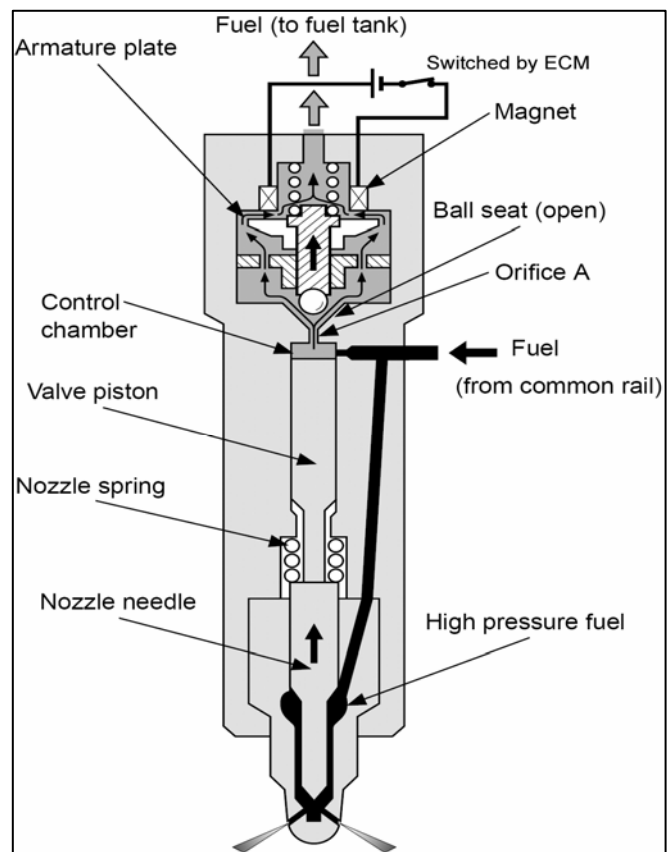
The nozzle needle is pushed down because of the difference in the pressure bearing areas of the valve piston and the nozzle needle, as well as the nozzle spring's set force, and the nozzle seat is closed. Consequently, fuel injection cannot be performed.



#### (ii) Beginning of Injection

When the magnet is energized, the armature plate is attracted upward by electromagnetic force and the ball seat is opened.

The high pressure fuel in the control chamber flows out through the ball seat and orifice A to the fuel tank. Because of this, the force of the high pressure fuel acting on the nozzle needle overcomes the force of the valve piston and the nozzle spring's set force, the nozzle needle is pushed up, and fuel injection begins. If energising of the magnet continues, the maximum injection rate is obtained.



## BOSCH COMMON RAIL DIESEL INJECTION

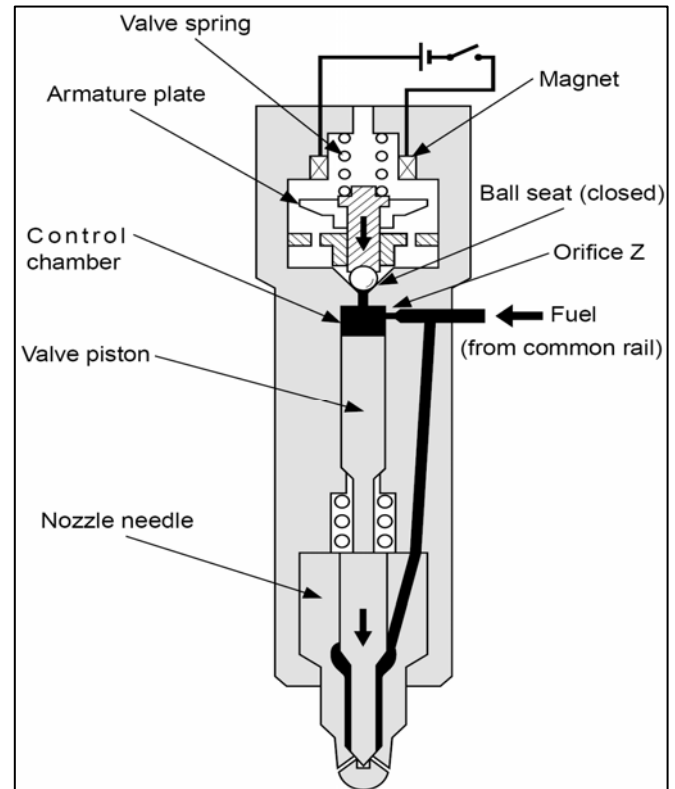
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### 3. Fuel Injector (BOSCH) .../Cont'd

#### Injector Operation;

##### (iii) End-of-injection

When the power to the magnet is stopped, the armature plate is pushed down by the valve spring and the ball seat is closed. At this time, high pressure fuel flows into the control chamber through orifice Z, the valve piston and the nozzle needle are pushed down, and fuel injection ends.

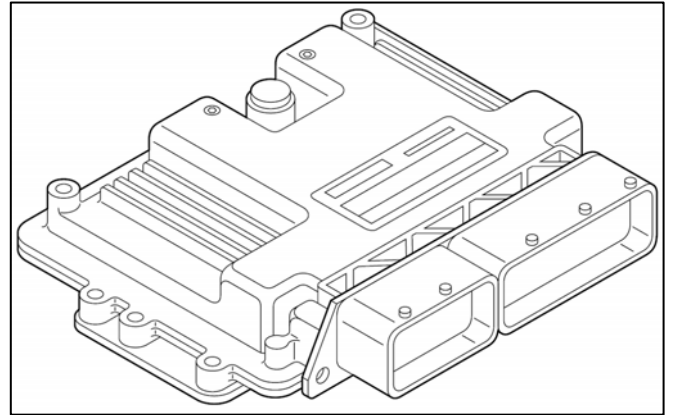


## BOSCH COMMON RAIL DIESEL INJECTION

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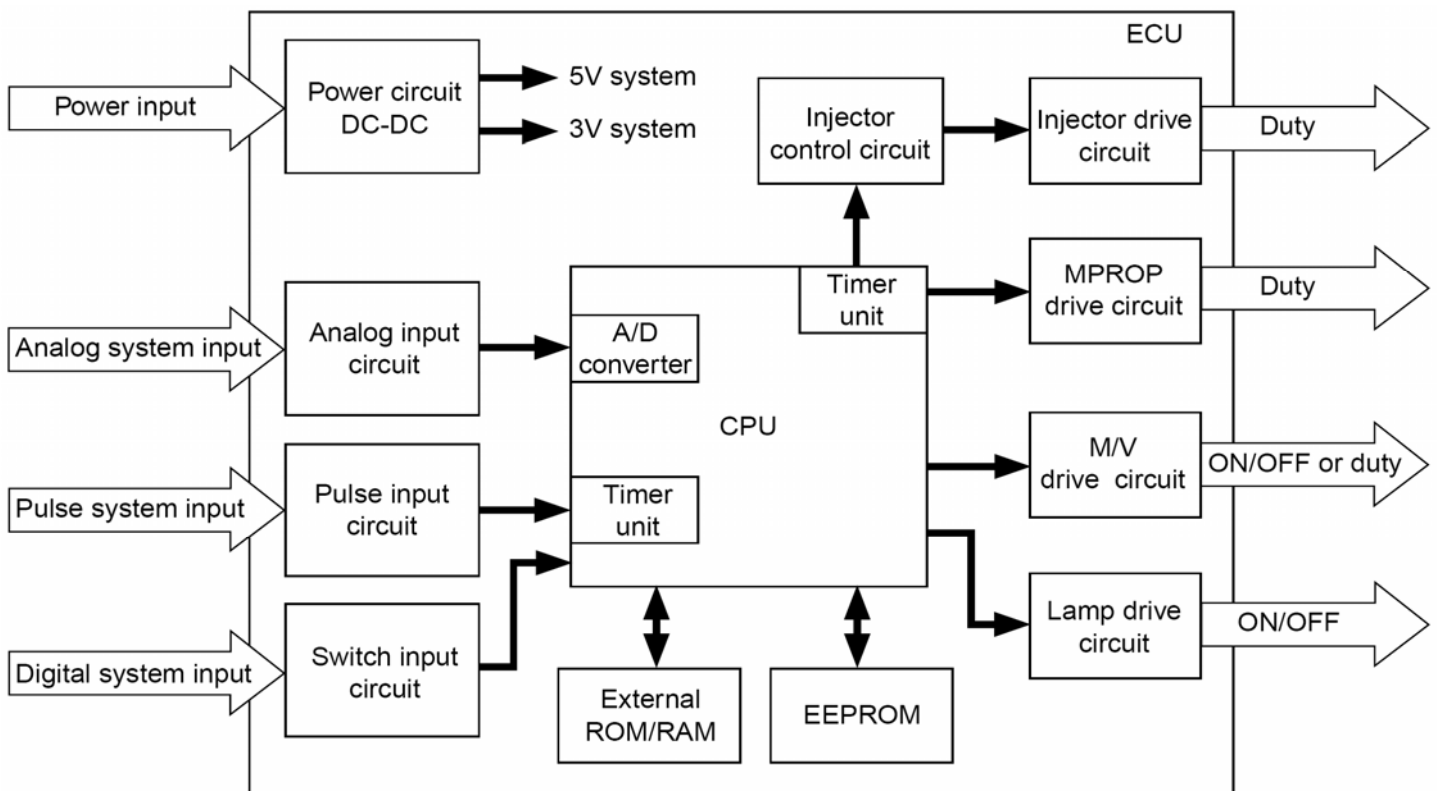
### 4. Electronic Control Module (ECM - BOSCH)

Information signals detected by the various sensors and switches are input to a microcomputer inside the ECM. In accordance with these information signals, characteristic data and compensation data recorded on the ROM (Read Only Memory device) are read into the CPU (the central processing unit). Computations are performed using this control data and the information signals from the input section, and the results are output as control signals. The control signals output from the microcomputer are converted to drive signals in accordance with their content. These drive signals are output to the injectors and the solenoid valves to control injection quantity and injection timing.



**NEVER “swap” a known GOOD ECM to a problem vehicle. Fit the suspect ECM to a known good vehicle instead. If it is proven to be a failed ECM, then there is a fault in the vehicle which caused the failure of the ECM. LOCATE & REPAIR THE FAULT prior to installing a new ECM to a problem vehicle.**

**As a rule of thumb, ECM failures are EXTREMELY RARE. Fuel, Air, Power & Ground issues are most typically the cause of engine running faults.**





## BOSCH COMMON RAIL DIESEL INJECTION

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### Service & Repair of Bosch Fuel System Components

#### 1. High Pressure Fuel Pump;

If the diagnosis process has been correctly followed & it has been determined that the Fuel Pump is at fault, please refer to **GI07-006a** for repair or instructions. Only a specific Bosch agent is authorised to inspect, dismantle & repair these Fuel Pumps.

**DO NOT ORDER A NEW PUMP FROM PARTS TO REPAIR A PUMP OR SUSPECT PUMP PROBLEM. If this occurs without any authorisation from Nissan, any warranty claim made will be DENIED.**

#### 2. Injectors;

If the diagnosis process has been correctly followed & it has been determined that the Injectors are at fault, please refer to **GI07-006a** for repair or instructions.

#### 3. Fuel Rail;

If the diagnosis process has been correctly followed & it has been determined that either the Fuel Rail, Fuel Rail Pressure Sensor &/or the Fuel Pressure Regulating Valve is at fault, please order a COMPLETE NEW FUEL RAIL ASSEMBLY via normal parts channels as the rail & attached components are not serviceable & are not supplied separately.

#### 4. Steel Fuel Tubes;

Once removed, these components must NEVER be reused. Order replacement ones via normal parts channels. Refer to page 14 of this manual for more detail.

#### 5. ECM;

It is HIGHLY UNLIKELY that the ECM has failed, however if it suspected that the ECM has done so, install it into a known good vehicle. NEVER "swap" a known GOOD ECM to a problem vehicle. If it is proven to be a failed ECM, then there is a fault in the vehicle which caused the failure of the ECM. LOCATE & REPAIR THE FAULT prior to installing a new ECM to a problem vehicle.

As a rule of thumb, ECM failures are EXTREMELY RARE. Fuel, Air, Power & Ground issues are most typically the cause of engine running faults.

Replacement ECM's are available via normal parts channels.

## BOSCH COMMON RAIL DIESEL INJECTION

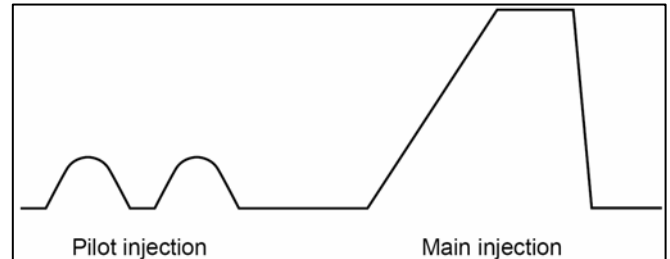
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### Fuel Injector Operation

#### 1. Pilot Injection

Pilot injection precedes the usual injection (ie, main injection) and is the injection of a very small quantity of fuel.

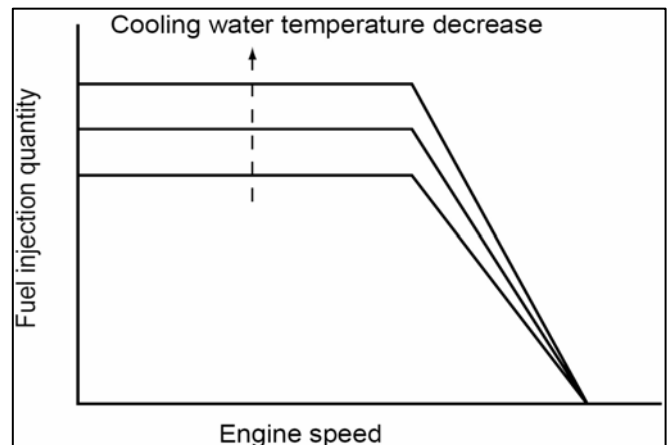
Pilot injection suppresses the initial generation of heat to decrease NOx and noise generated at the beginning of combustion.



#### 2. Fuel Injection Quantity Control

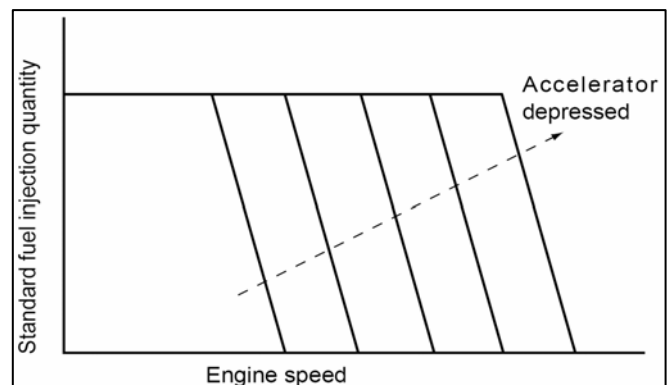
##### (i) Fuel injection quantity at engine starting

At engine starting, the fuel injection quantity is determined by the engine speed at starting and cooling water temperature.



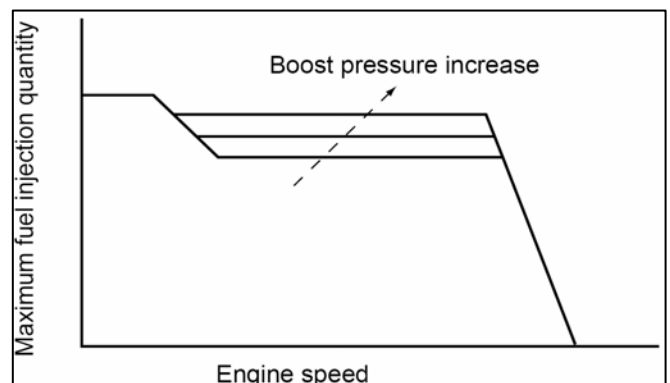
##### (ii) Standard fuel injection quantity

The standard fuel injection quantity is determined by the engine speed and accelerator position.



##### (iii) Maximum fuel injection quantity

The maximum fuel injection quantity is calculated from engine speed and boost pressure.



## BOSCH COMMON RAIL DIESEL INJECTION

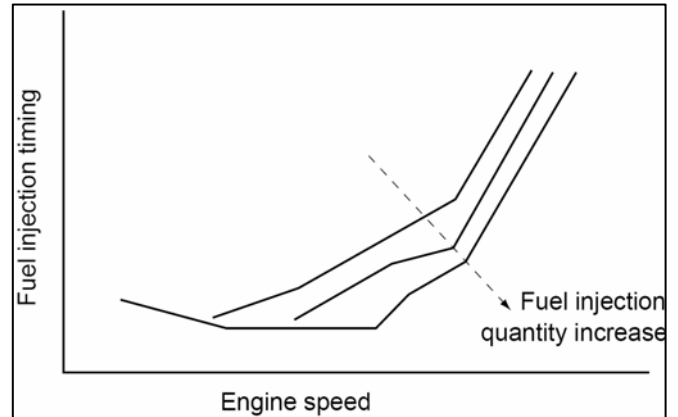
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### Fuel Injector Operation .../Cont'd

#### 3. Fuel Injection Timing Control

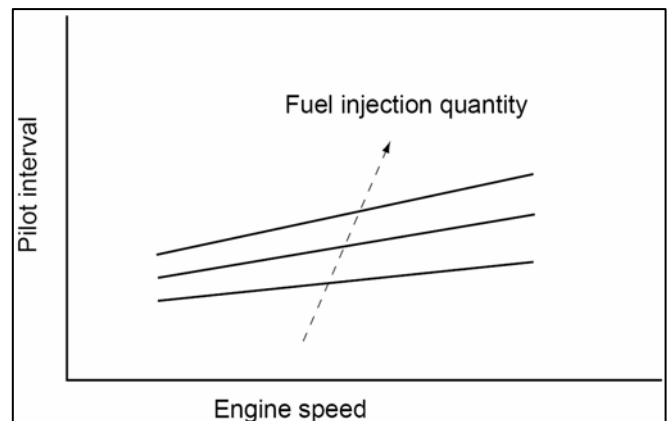
##### (i) Main Injection Timing

Main injection timing is calculated from the fuel injection quantity and engine speed.



##### (ii) Pilot Injection Timing (pilot interval)

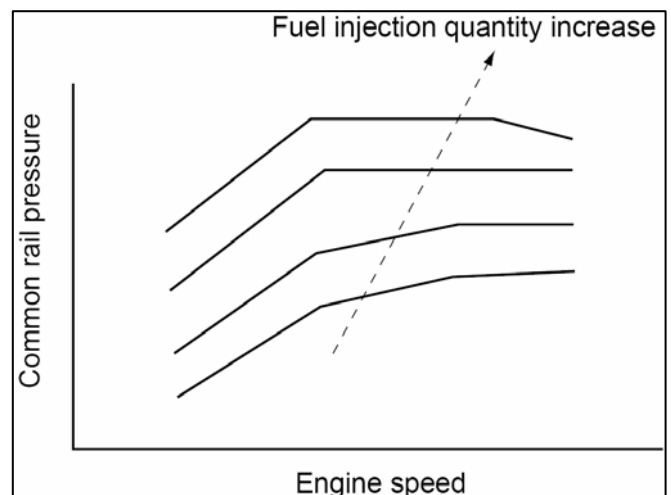
The pilot interval is calculated from the fuel injection quantity and engine speed.



#### 4. Fuel Injection Pressure Control

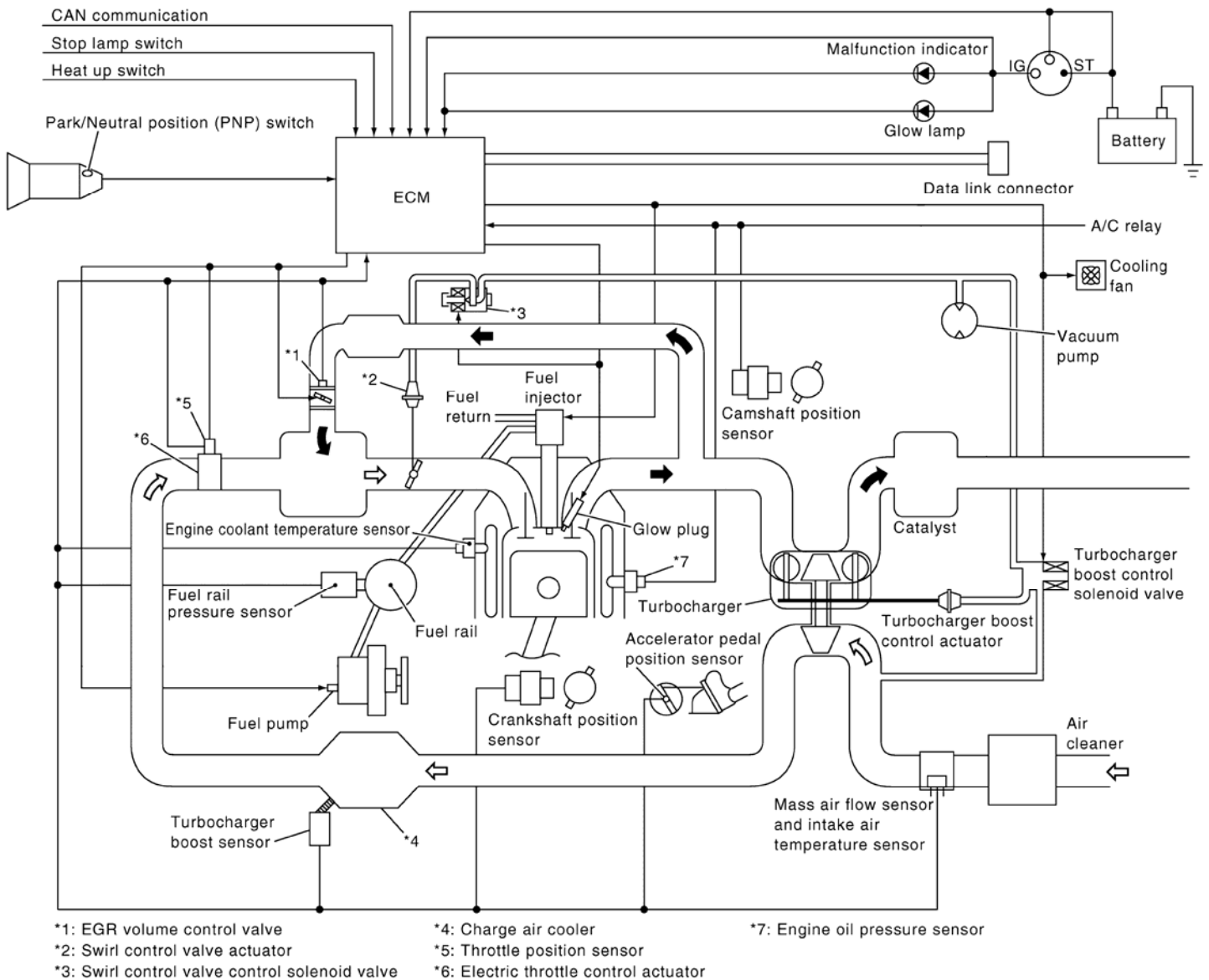
The fuel injection pressure is calculated from the fuel injection quantity and engine speed.

Pressure in the Rail is regulated by the Fuel Metering unit on the Fuel Pump.



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi - CRD



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi - CRD

| INPUT  | ECM FUNCTION                 | OUTPUT (ACTUATOR)   |
|--|------------------------------|---|
| BATTERY VOLTAGE<br>( & Ground)                         | FUEL INJECTION QUANTITY      | FUEL INJECTOR & PUMP  |
| IGNITION SWITCH ACTIVITY                               |                              |   |
| ACCELERATOR PEDAL ACTIVITY                             | FUEL INJECTION TIMING        |   |
| CRANK POSITION & SPEED                                 |                              |   |
| CAMSHAFT POSITION                                      | VEHICLE SPEED CONTROL (ASCD) |   |
| FUEL RAIL PRESSURE                                     |                              | GLOW <u>RELAY</u> & INDICATOR LAMP                                |
| HEAT SWITCH<br>(Fast idle warm up control)             | GLOW PLUG OPERATION          |   |
| ENGINE COOLANT TEMPERATURE                             |                              | EGR VALVE   |
| MASS AIR FLOW  | EGR VOLUME CONTROL           |   |
| INTAKE AIR TEMPERATURE                                 |                              | COOLING FAN <u>RELAY</u>  |
| TURBO BOOST<br>(Air Pressure in Intake)                | COOLING FAN CONTROL          |   |
| ASCD REQUEST FROM DRIVER                               |                              | TURBO BOOST CONTROL SOLENOID VALVE                                |
| ASCD CANCEL REQUEST<br>(Brake & Clutch pedal switches) | TURBO BOOST CONTROL          |   |
| BRAKE PEDAL ACTIVITY                                   |                              | ELECTRIC THROTTLE CONTROL VALVE                                   |
| GEAR LEVER POSITION (P/N)                              | THROTTLE VALVE CONTROL       |   |
| BAROMETRIC PRESSURE<br>(Altitude)                      |                              | AIR CONDITIONER COMPRESSOR <u>RELAY</u>                           |
| ENGINE OIL PRESSURE                                    | AIR CONDITIONER CONTROL      |   |
| EGR VALVE POSITION                                     |                              | SWIRL VALVE SOLENOID  |
| THROTTLE VALVE POS'N                                   | SWIRL VALVE CONTROL          |   |
| * VEHICLE SPEED  |                              | MALFUNCTION INDICATOR LAMP & ECM<br>(SELF DIAGNOSIS – CONSULT II) |
| * AIR CONDITIONER REQUEST                              | ON BOARD DIAGNOSIS           |   |
| (* CAN COMMUNICATION)                                  |                              |   |

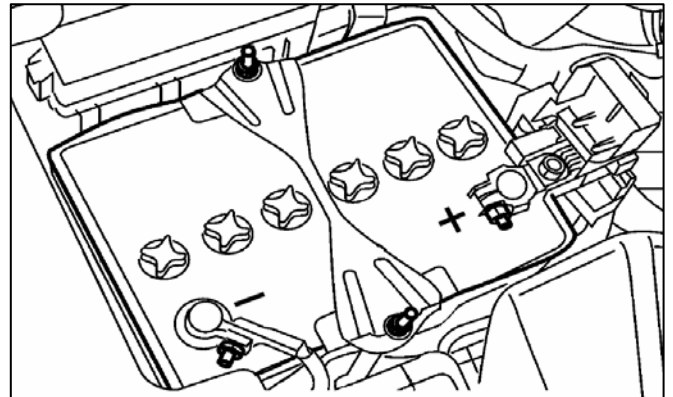
## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 1a. Battery Voltage

This is an extremely important input to the ECM for engine operation.

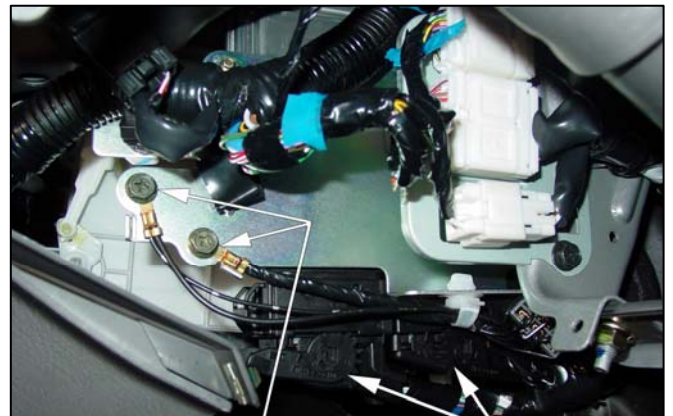
Ensure that the voltage level remains stable, especially during cranking. A situation may be possible where there is enough battery voltage for cranking, however there may be an insufficient level for the ECM to operate properly.



#### 1b. ECM Ground

Even though a decent voltage supply is available to the Engine Control System, if the ECU or major fuel system components do NOT have a decent Ground connection, then correct operation of the Engine System will NOT be possible.

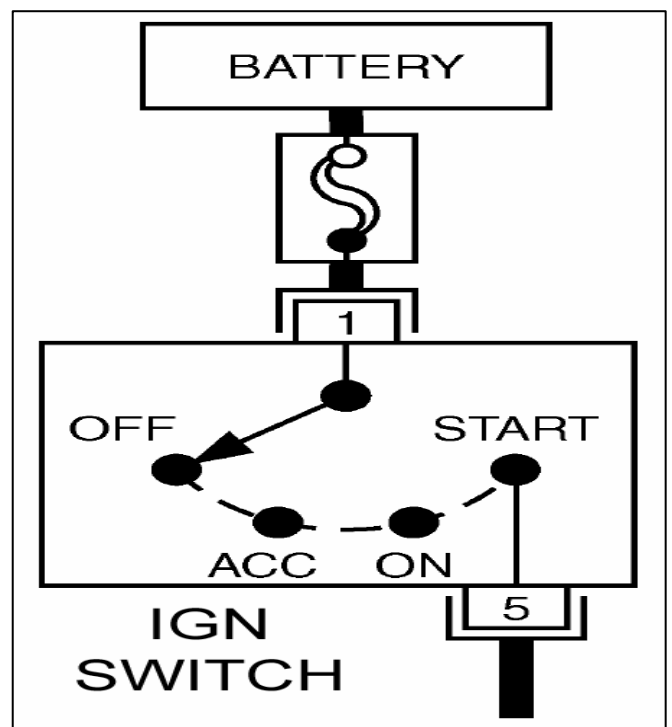
Please ensure the Ground connections as shown here are in good condition (Clean & Tight.)



ECM, TCM & BCM Grounds      ECM Harness Connectors  
ECM located under dash, left of steering column

### 2. Ignition Switch

The ECM needs to know if the engine is being cranked, if the Ignition Switch is simply ON, held in the cranking position & of course when it is OFF.



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 3. Crankshaft Position Sensor (CKPS)

The CKPS is located at the front of the cylinder block directly above the front pulley. It is attached to a bracket above the pulley & is facing the teeth of the signal plate on the rear of the front pulley.

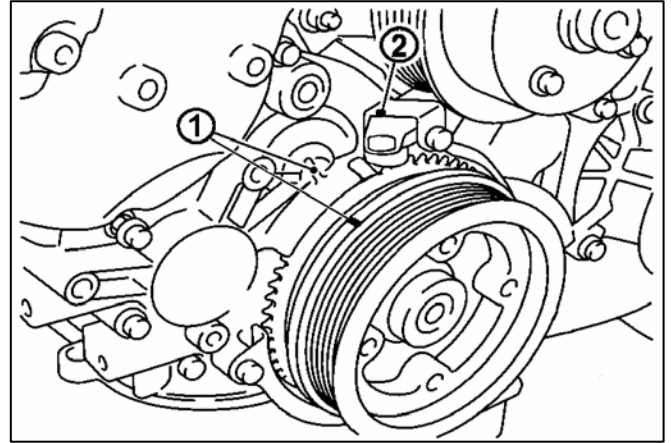
The CKPS informs the ECM of the following information;

- The position of the crankshaft
- If the crank is actually moving & if so how fast?

A section of the signal plate has teeth missing, which is used to determine the TDC point.

1; TDC timing marks.

2; CKPS



#### 4. Camshaft Position Sensor (CMPS)

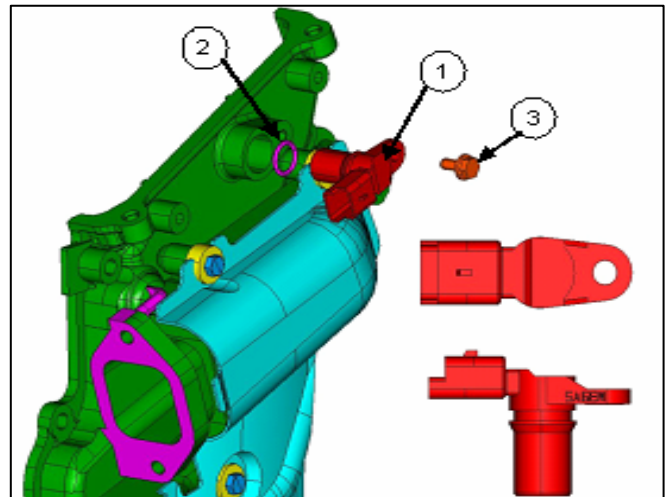
The CMPS is located at the front of the cylinder head. It senses the camshaft rotation.

The ECM uses this information to identify a particular cylinder's piston position and firing order.

When the CKPS circuit becomes inoperative, the CMPS is able to be used as a back-up signal.

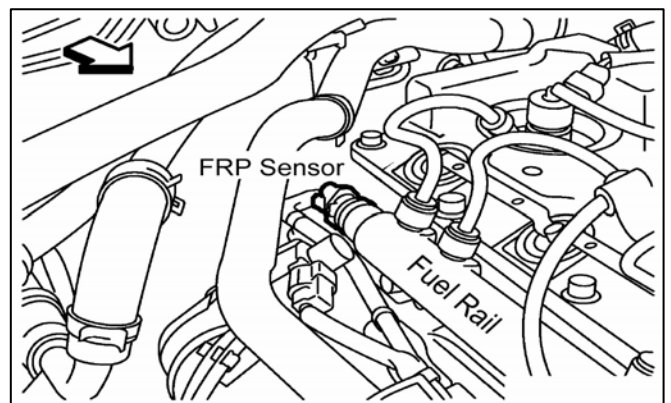
This provides some control of the engine management system by utilising the timing of cylinder identification signals.

They are of a permanent magnet and Hall IC construction.



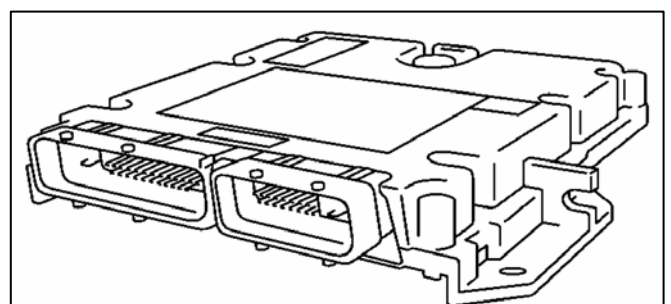
#### 5. Fuel Rail Pressure Sensor (FRPS) (BOSCH)

The FRPS is an extremely important input into the ECM. From this signal, the ECM can determine how to operate the Solenoid on the Fuel Pump in order to vary the amount of fuel that is forced into the Fuel Rail.



#### 6. Barometric Sensor (BOSCH)

The Barometric Pressure Sensor is built into ECM. The sensor detects barometric pressure (altitude) and sends the voltage signal to the microcomputer.



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

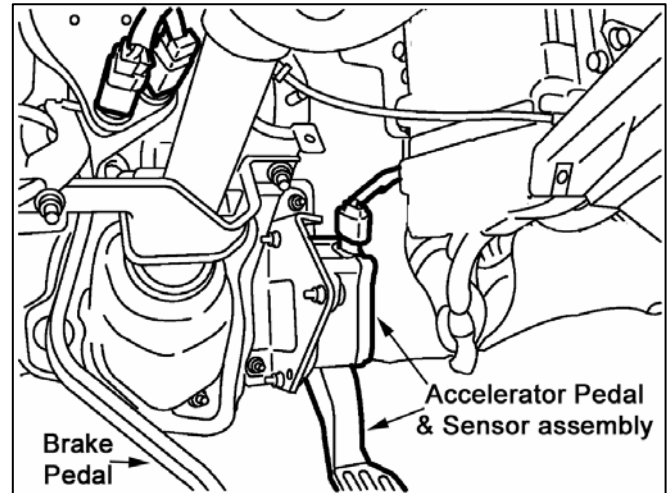
#### 7. Accelerator Pedal Position Sensor (APPS)

The APPS is installed on the upper end of the accelerator pedal assembly. The sensor detects the following items of information;

- Actual accelerator pedal position
- If the pedal is actually moving (being pushed by the driver or not) and if it is moving, the rate of movement (rapid movement or gentle / slow movement)

The signal is sent to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.

The signal is also utilised by the TCM for shift control & the ECM for A/C compressor cut.



#### SPECIAL NOTE:

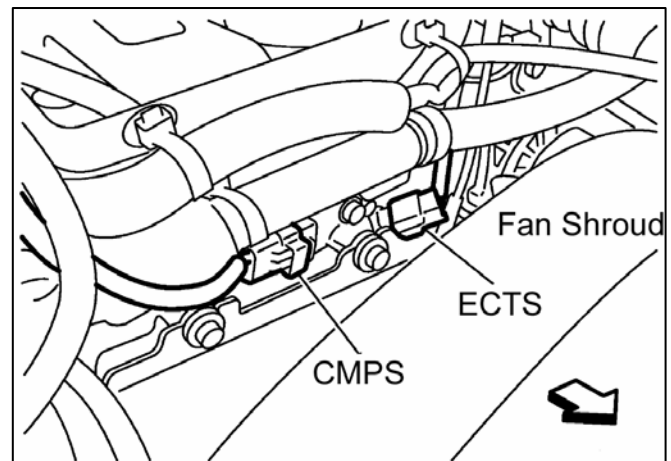
The signal from the accelerator pedal will be IGNORED & the engine will revert to normal idle control

If the brake pedal is applied whilst the vehicle is being driven. Refer to page 40 for more detail

#### 8. Engine Coolant Temperature Sensor (ECTS)

The ECTS is used to detect the engine coolant temperature.

It's design & operation is the same as other ECT sensors utilised by the Nissan engine range.



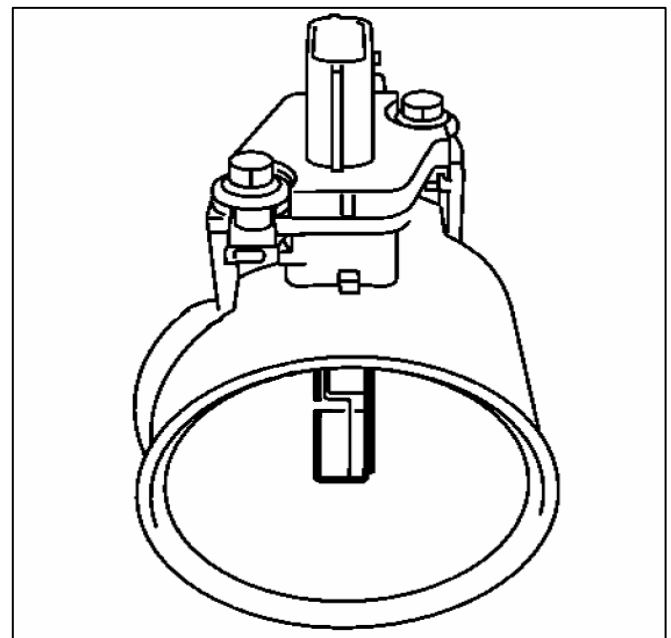
#### 9. Mass Air Flow Sensor (MAFS)

The MAFS is placed in the stream of intake air. It measures the intake flow rate by measuring a part of the entire intake flow.

The MAFS controls the temperature of the hot wire to a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss.

Therefore, the electric current supplied to the hot wire is changed to maintain the temperature of the hot wire as air flow increases.

The ECM detects the air flow by means of this current change.



#### 10. Intake Air Temperature Sensor (IATS)

The IATS is built into the MAFS. The temperature sensing unit uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

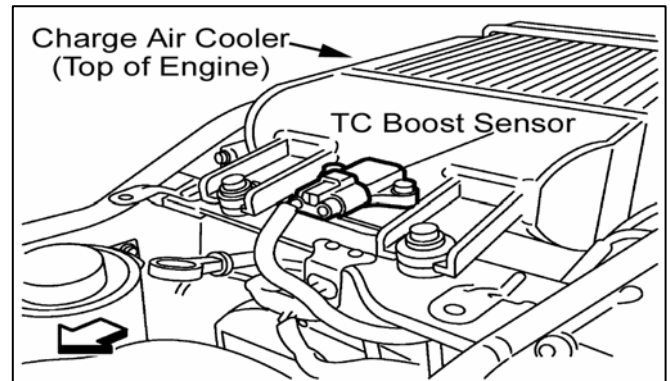


## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 11. Turbo Charger (TC) Boost Sensor

The Turbo Boost Sensor detects pressure in the exit side of the Charge Air Cooler (Intercooler). The sensor output voltage to the ECM increases as pressure increases.

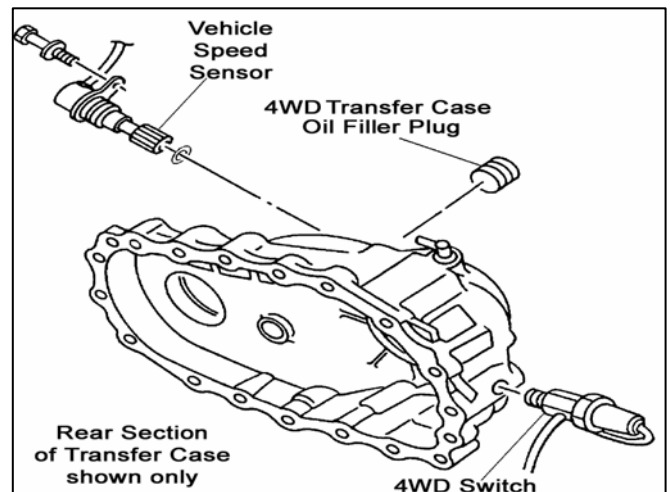


#### 12. Vehicle Speed Signal (VSS)

The ECM receives VSS via CAN communication line. Even though it is sent from the combination meter, the source of the signal originates from the Vehicle Speed Sensor located at the rear of the Transfer unit. The VSS sends the signal directly to the instrument cluster (Unified Meter Control Unit) via a dedicated wiring connection. From there the UMCU outputs the Vehicle Speed signal onto the CAN for use by other systems in the vehicle that require a VSS.

The ECM primarily uses this signal for ASCD control.

**NOTE:** Ti variants have a local fit Satellite Navigation system. Refer to **AWB 017a/06** for detail regarding the supplier & repair information. The system requires a vehicle speed input which is taken directly from the Vehicle Speed Sensor.

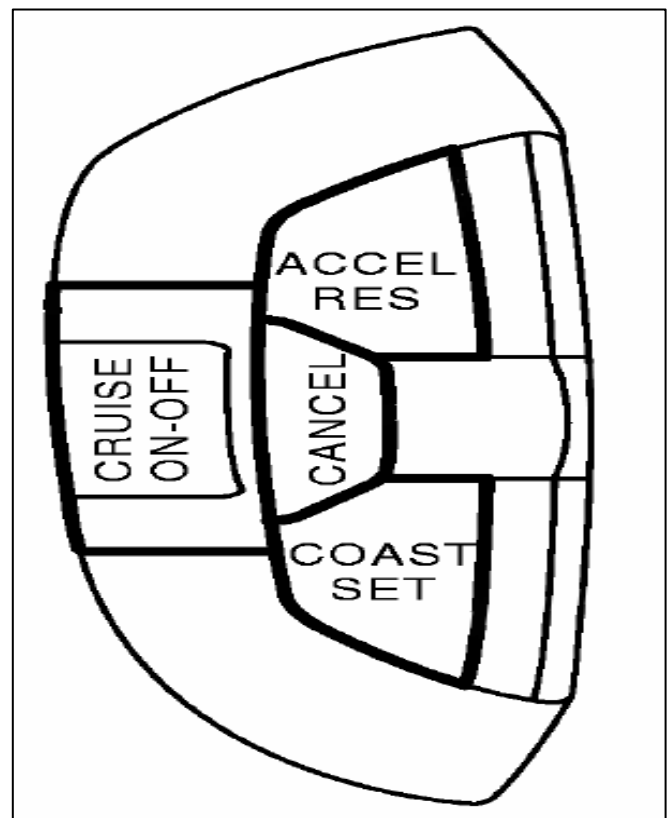


#### 13. Automatic Speed Control Device (ASCD) Switches

ZD30 CRD Y61 is available with ASCD. (Cruise Control) The control switches are mounted on the steering wheel and each has a varying values of electrical resistance for each button.

The ECM reads the voltage variation of the switch that is pressed and determines which button is operated.

The switches are mounted on the steering wheel.



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

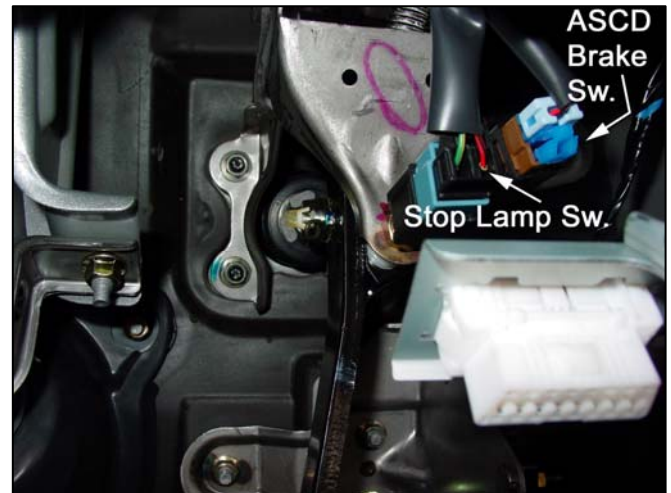
#### 14. ASCD Brake (pedal) Switch (Normally Closed)

When the brake pedal is depressed, ASCD Brake Switch and Stop Lamp Switch are turned ON. The ECM detects the state of the brake pedal by these 2 SEPARATE inputs.

On M/T models, there is also a Clutch Pedal Switch, if the Clutch Pedal is depressed the Switch individually sends an "Open Circuit" signal to the ECM. ASCD operation is cancelled as a result

#### 15. Stop Lamp Switch (Normally Open)

The Stop Lamp Switch is installed to the brake pedal bracket. The switch senses brake pedal position and sends an ON-OFF signal to the ECM (as well as illuminating the rear brake lights). It is located on the brake pedal bracket, adjacent to the ASCD Brake Switch.



**NOTE;** If the brake pedal is applied whilst the accelerator is being applied to drive the vehicle, the engine will revert to normal idle control regardless of the accelerator pedal position.

**Care MUST** be taken with the fitment if **ANY** electrical accessories that require a **STOP LAMP** switch input are being installed to the vehicle

### Accelerator and Brake mutual comparison diagnosis (Failsafe Control)

This diagnosis is designed to return the engine to normal idle when the driver depresses the brake pedal whilst the accelerator pedal is being held to drive the car (ASCD OFF) The new diagnosis feature judges that driver wants to stop driving the vehicle. (ECU judges that the accelerator pedal is hanging).

However if the brake pedal is depressed **prior** to the accelerator pedal being depressed, it will **not** drop engine RPM.

Activation conditions;

- Engine RPM; >1000rpm
- Vehicle speed; >5km/h

#### **NOTE:**

T31 X-TRAIL QR25 & M9R also utilise this strategy as well as 1998 R20 Terrano models fitted with the Bosch supplied fuel control system on the TD27ETi engine.

### DTC P0504 ASCD BRAKE SWITCH

This DTC will most likely be logged due to illogical Stop Lamp Switch & ASCD Brake Switch operation. Ensure that they are adjusted so that the both operate at the exact same time when the brake pedal is depressed. Use the DATA MONITOR Bar Graph to ensure they are adjusted correctly.

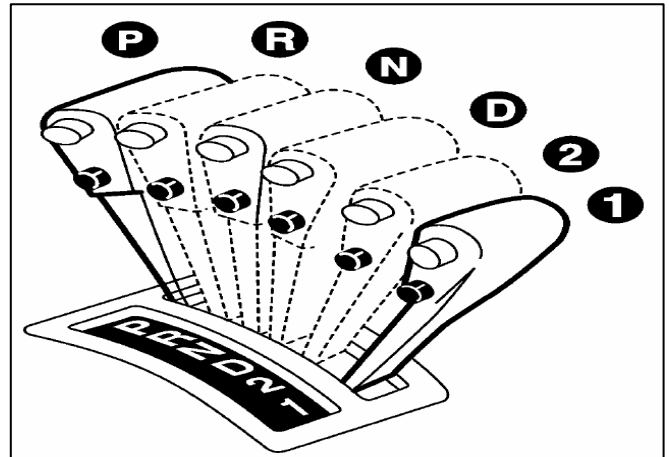
## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 16 a. PNP Switch – AT Models

When the gear position is in P or N (A/T) the Park / Neutral position is ON. ECM detects the position via a signal sent out on the CAN.

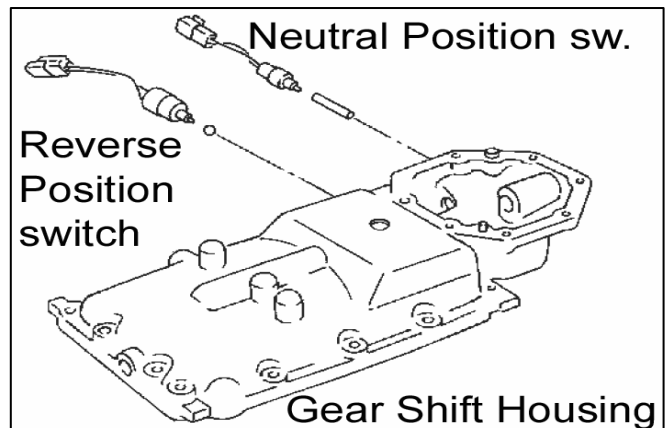
The actual switch signal is sent from the shift lever position switch located on the A/T assembly to the instrument cluster. The cluster issues the signal out on the CAN & from there the ECM receives the P/N signal. If the ECM receives a P/N signal (due to a faulty switch or wiring for example) whilst the vehicle is being driven, a DTC will be logged.



#### 16 b. PNP Switch – MT Models

When the gear lever is in N the neutral position switch is ON (P/N Posi is ON). The ECM detects the position as the switch is connected directly to the ECM.

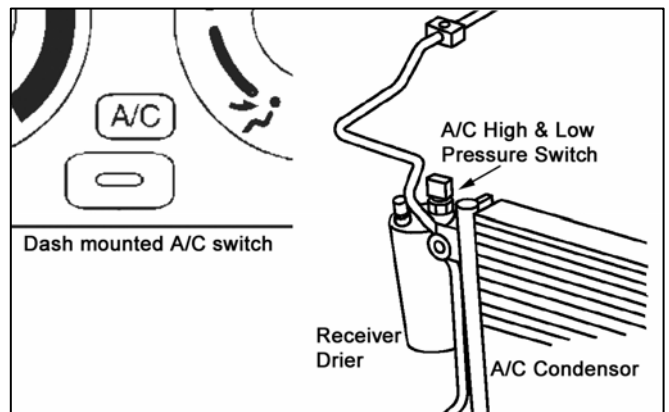
If the ECM receives a P/N signal (due to a faulty switch or wiring for example) whilst the vehicle is being driven, the engine performance will be reduced. Monitor the activity of the switch ("P/N POSI") in Data Monitor to confirm it's correct operation.



### 17. A/C Control & Refrigerant Pressure Switches

For A/C operation to occur, the dash mounted A/C switch must be on (as well as cabin fan switch) and the High / Low pressure switch mounted on the Receiver Drier unit must be in a closed circuit condition.

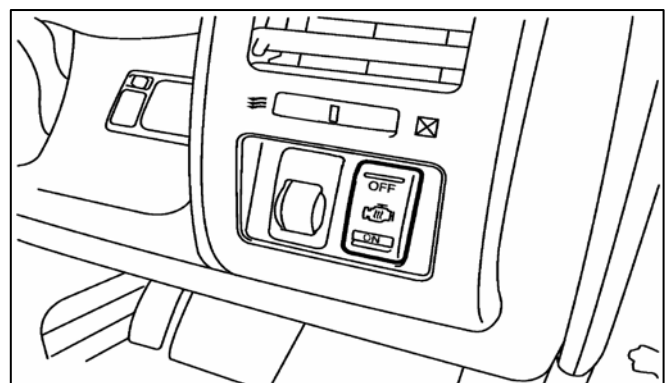
The signal from the switches is sent to the Unified Meter Control Unit (instrument cluster) & the ECM receives the "A/C ON" request from the cluster via CAN. The ECM then operates the A/C Compressor Relay.



### 18. Heat Switch

This feature continues from previous models. The switch is used to increase the idle speed & to warm up the engine at a faster rate for improved cabin heater operation.

|                            |                               |
|----------------------------|-------------------------------|
| Heat up switch             | ON                            |
| Engine coolant temperature | Below 105°C (221°F)           |
| Shift lever                | P or N (A/T)<br>Neutral (M/T) |
| Accelerator pedal          | Fully released                |



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 19. Engine Oil Pressure Sensor

An Engine Oil Pressure Sensor is now utilised in place of the Oil Pressure “High” switch utilised on the previous Engine.

The signal from the pressure sensor is sent directly to the ECM. If the ECM detects that the Oil Pressure has fallen below a certain value for given conditions, a signal is sent from the ECM to the Instrument Cluster via CAN. The Instrument Cluster will then illuminate the Oil Pressure warning light (Red Oil Can).

A standard Oil Pressure “Low” switch continues to be used as well. It is located adjacent to the Oil Filter & it's connected directly to the instrument cluster only. It illuminates the “Red Oil Can” in the conventional manner.

Refer to page 70 of this Training Manual for further discussion on the operation of the Engine Oil Pressure warning light.

#### Engine Oil Pressure Warning Light Operation

If the ECM detects the below conditions, it sends a signal to the Instrument Cluster via CAN.

After the ECM has detected the following conditions for MORE than 5 seconds;

- a) Engine rpm: 3600 – 4200rpm
- b) Coolant temp: Less than 95 deg C
- c) Oil pressure: Less than 2.5 BAR (Oil pressure sensor voltage less than 2V approx.)

The “RED OIL CAN” warning light on the instrument cluster is illuminated by the Unified Meter Control Unit (instrument cluster) after it receives a request from the ECM via CAN to illuminate the light.

#### Engine Oil Pressure Inspection

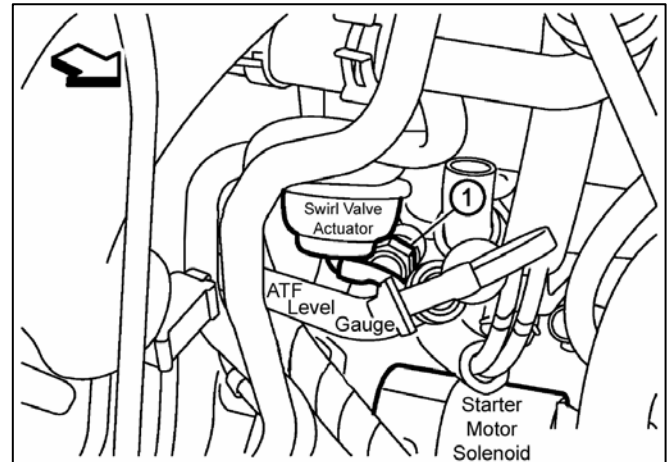
If there is any doubt over the Oil Pressure in the Engine, the Engine Oil Pressure Sensor located above the Starter Motor should be removed & a **Known Good Oil Pressure Gauge** should be installed.

With the engine running at various speeds, the Oil Pressure should be observed & the results written down.

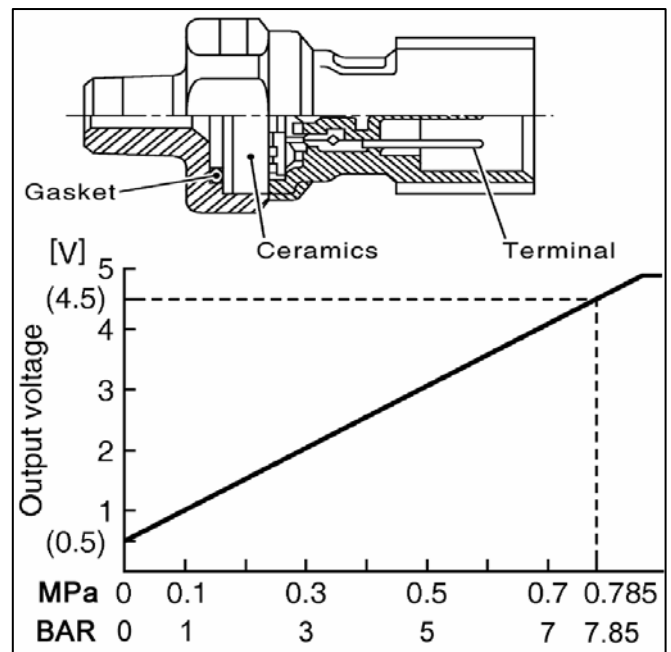
#### Note;

DO NOT TAKE THE ENGINE OIL PRESSURE READINGS FROM THE OIL PRESSURE SWITCH LOCATION.

The Oil Pressure SWITCH is located adjacent to the Oil Filter.



1; Oil Pressure Sensor



| Engine speed rpm | Approximate discharge pressure kPa (bar, kg/cm <sup>2</sup> , psi) |
|------------------|--|
| Idle speed       | More than 196 (2.0, 2.0, 28)                                       |
| 2,000            | More than 392 (3.9, 4.0, 57)                                       |
| 3,300            | More than 635 (6.4, 6.5, 92)                                       |

## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Inputs to ECM

#### 20. EGR Volume Control Valve Position Sensor

The ECM can monitor the movement of the EGR Valve via a feedback sensor installed on the EGR Volume Control Valve assembly. The ECM regulates electrical current to the valve to either open or close it. The ECM waits for a feedback signal from the position sensor mounted on the valve assembly to observe the Valves new position.

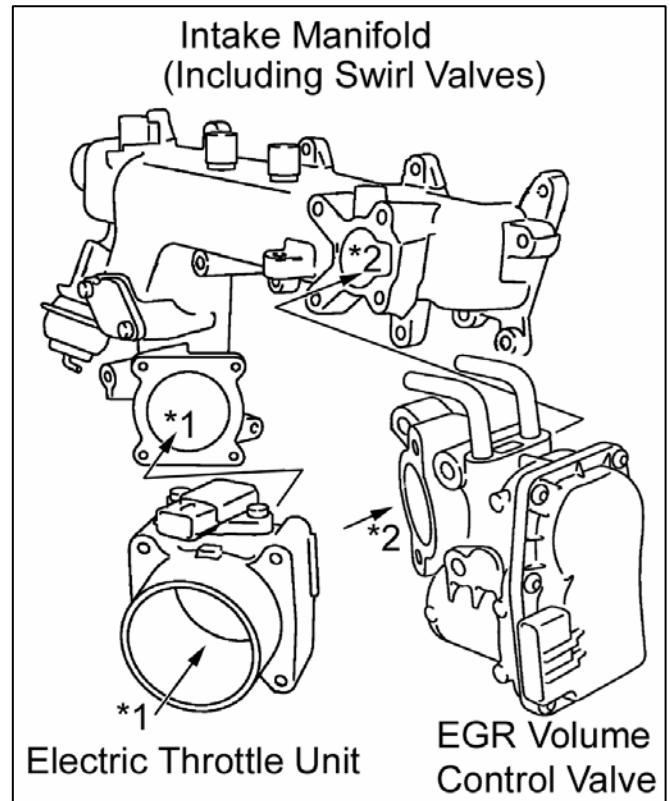
The basic operation of the EGR Volume Control Valve is similar to an Electric Throttle Control (ETC) assembly commonly used on current petrol engines.

#### 21. Throttle (valve) Position Sensor (TPS)

The TPS is mounted on the Electric Throttle Control valve assembly . As described above, the sensor monitors the position of the Throttle Valve & feeds the information back to the ECM.

The basic operation of the Electric Throttle Control Valve assembly is similar to an Electric Throttle Control Valve assembly commonly used on current petrol engines.

The Electric Throttle Control Valve assembly is used for smooth engine shut down only. It replaces to the vacuum operated Intake Air Control Valve which was located on top of the rocker cover of the pervious ZD30 engine. With the engine running, this valves remains WIDE OPEN at all times.



\*1; Passage the main air flow travels after it exits the Charge Air Cooler.

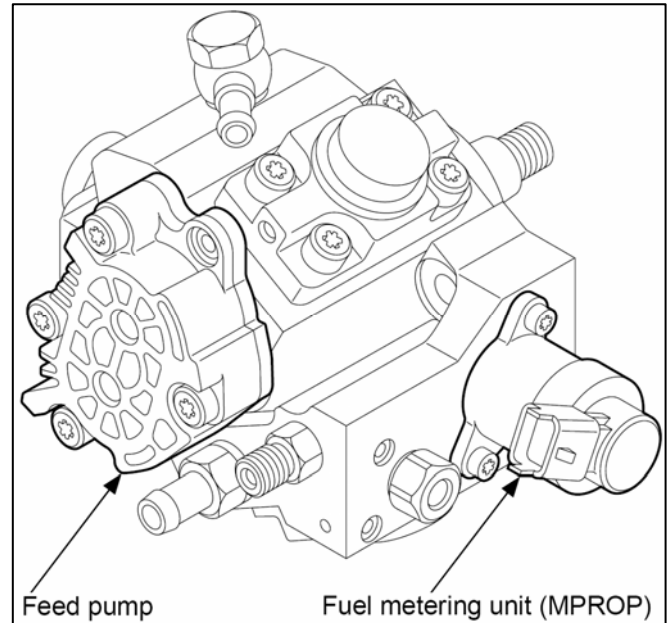
\*2; Passage the exhaust gas travels.

## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Outputs from ECM

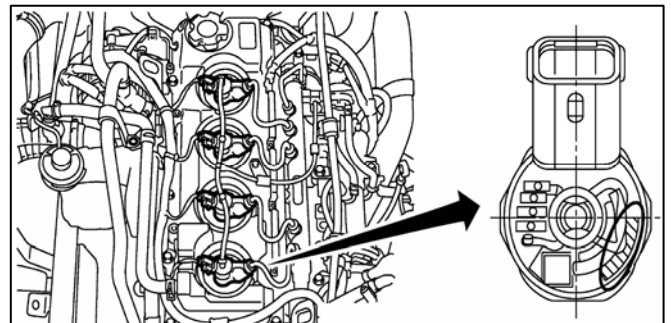
#### 1. Fuel Metering Unit (MPROP) (BOSCH)

As already discussed earlier in this manual, the ECM controls this valve in order to regulate the amount of fuel that is allowed to be delivered (forced into) the Fuel Rail. The Fuel Metering unit in principal works in a similar manner to the Suction Control Valve (SCV) on the Denso High Pressure Fuel pump fitted to R51 / D40 models with the YD25 engine.



#### 2. Fuel Injector (BOSCH)

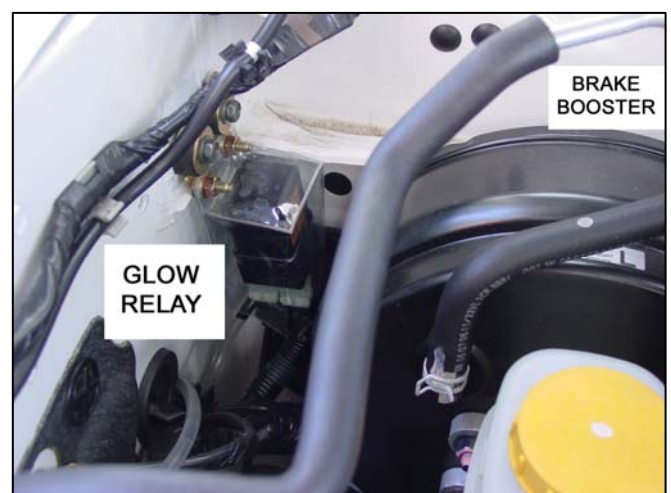
Once again the Fuel Injector has been discussed earlier in this manual. The operation of the Injector is in principle the same as the operation of the Injector in a gasoline engine. The ECU has complete control of when the Injector is open, how long it is opened for & in turn the amount of times the Injector is open & shut in 1 piston cycle.



**PLEASE OBSERVE THE SAFETY PRECAUTIONS REGARDING THE HIGH VOLTAGE WHICH OPERATES THE FUEL INJECTORS. REFER TO STB GI 05-007 FOR MORE DETAIL.**

#### 3. Glow Relay

The ECM operates the Glow Relay in the same manner as other electronically controlled diesel engine vehicles. Once the relay is switched ON by the ECM, it feeds power through to the Glow Plugs.



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Outputs from ECM

#### 4. Electric Cooling Fan Relay

Whenever the A/C is operated regardless of the engine or ambient temperature, the electric cooling fan located behind the grill is operated. The ECM in actual fact switches on a relay which in turn directs current to the fan motor. If the engine temperature exceeds a pre-determined level the electric fan is also operated with or without the A/C switched on.

#### 5. Air Conditioner Relay

The ECM has the final control over the A/C compressor operation via control of a relay. The driver request for A/C comes from the A/C Amplifier (Auto Temp Control models) or the control panel switch (Manual Temp Control models) on the dash. The signal is sent to the instrument cluster. The signal is then sent from the instrument cluster to the ECM via the CAN.

If conditions such as acceleration demand, excessive engine temperature, excessive A/C system pressure or lack of A/C system pressure (no gas) are NOT evident, the ECM will operate the A/C relay which will direct power to the A/C compressor clutch.

#### 6. EGR Volume Control Valve

The EGR valve is an all new design for the ZD30 CRD engine.

It simply works like a conventional Electric Throttle Control (ETC) valve found on current Petrol engine models.

The valve is operated via a simple 12V DC electric motor. As the valve opens & closes, there is a sensor following the movement of the valve. This sensor sends a signal back to the ECM & therefore the ECM can see what the position the valve is at for any given moment.

#### NOTE:

If the EGR Valve is disconnected, removed & refitted or replaced, YOU MUST carry out the following operations;

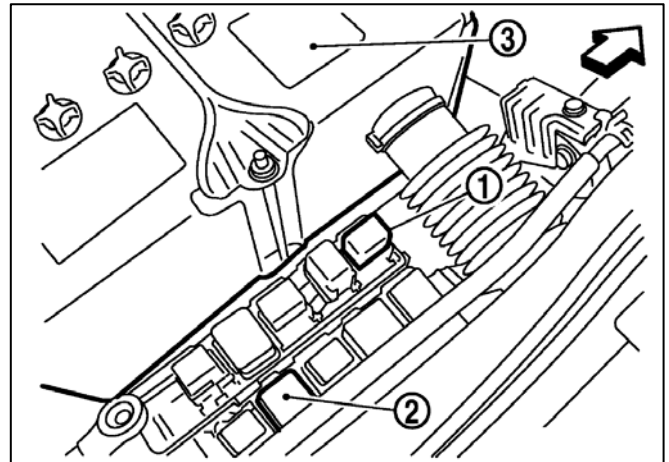
- EGR Volume Control Valve Closed Position

Learning Value Clear

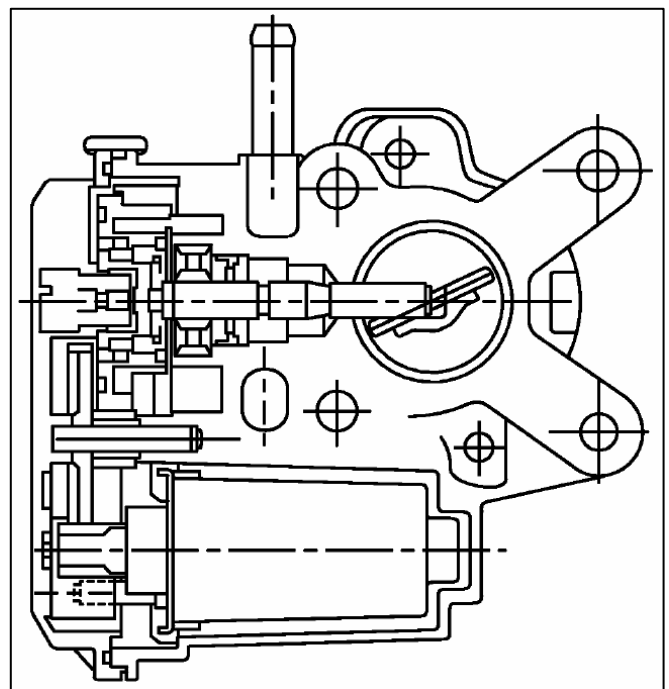
- EGR Volume Control Valve Closed Position

Learning

Please refer to section EC - Basic Service Procedure in the Service Manual for more detail.



1; Cooling Fan Relay. 2; A/C Compressor Relay  
3; Battery



## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Outputs from ECM

#### 7. TC Boost Control Solenoid Valve

Like the previous ZD30 engine on Y61 & the YD engine in R51 & D40, the Turbo Charger is a Variable Nozzle Turbo.

Vacuum is supplied to the actuator on the turbo. If a high level of vacuum is applied, the actuator rod is forced to lift which in turn allows for maximum boost.

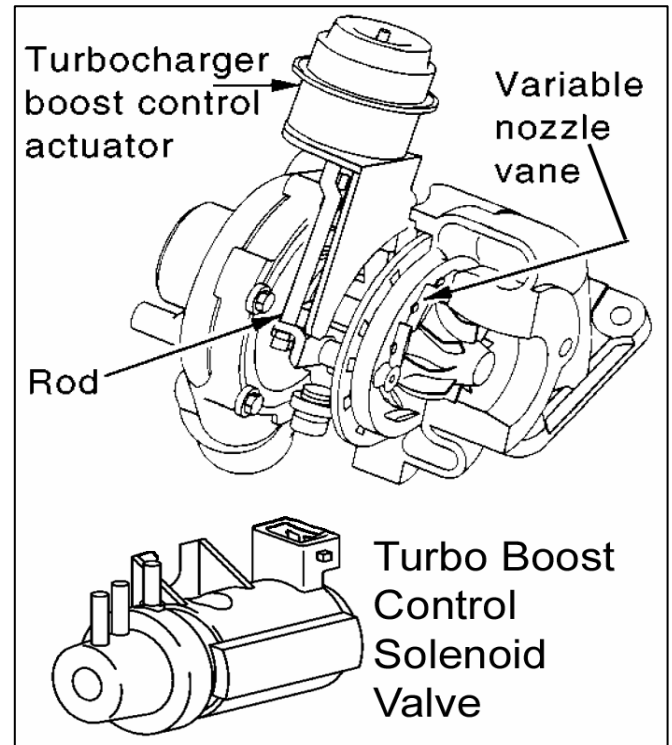
If the vacuum supply is cut, the rod will then be forced to drop with the assistance of spring pressure. The end result is no turbo boost.

The Turbo Boost Control Solenoid Valve is designed to allow vacuum to be applied or stop vacuum being applied to the actuator. The ECM has the ability to provide a partial vacuum situation for partial turbo boosting as well. This is via an ON / OFF pulse being applied to the solenoid by the ECM.

#### NOTE:

As part of a "Lack of Power" trouble diagnosis, ALWAYS ensure that the vacuum pump is functioning OK.

If the vacuum pump is worn & it is not providing sufficient vacuum, the turbo will not operate properly. As a result the engine will lack power due to lack of Turbo Boost.



#### 8. Electric Throttle Control Actuator

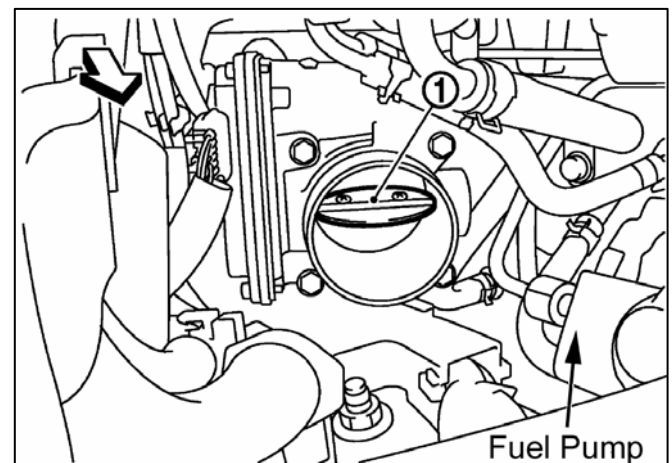
For the purpose of reducing engine shake during shut down, an Electric Throttle Control Valve is fitted to the inlet manifold. All air that exits the Charge Air Cooler travels through this valve.

On the previous ZD engine an Intake Air Control Valve was utilised for the exactly the same purpose. It was vacuum operated via an ECM controlled solenoid & the valve was located on top of the rocker cover.

The type 1 YD25 engine in R51 & D40 models also have a vacuum operated Intake Air Control Valve which serves the same purpose.

When the ignition switch is turned to the OFF position, the ECM activates a DC motor which rotates a throttle valve to block the intake air passage. This action, along with fuel cut at the injectors will stall the engine in a smooth manner.

The ECM is able to monitor the valves position via a feedback sensor (TPS). The overall operation of the motor is very much like the Electric Throttle Control (ETC) valve fitted to current petrol engines. Obviously the valve remains in a wide open condition until the ECM activates the DC motor to close it.





## ENGINE CONTROL SYSTEM - EC

### ZD30DDTi Outputs from ECM

#### 9. Malfunction Indicator Lamp (MIL - ORANGE)

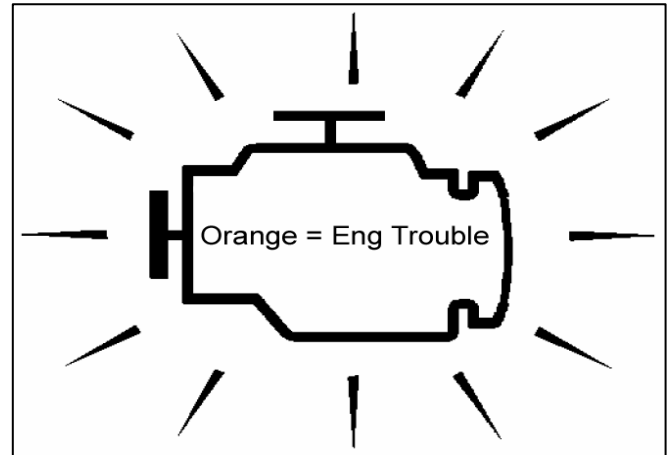
The MIL is located on the Instrument cluster (Bottom left below the Fuel Gauge). It illuminates in the typical ORANGE colour & it indicates an engine system fault. Use of CONSULT is required to extract DTC(s).

##### NOTE 1:

For Non CRD ZD30 engines (2000 ~ 2006MY), this light also acts as the "Water In Fuel" warning light. There will be no DTC's logged in the case of Water in Fuel for this model.

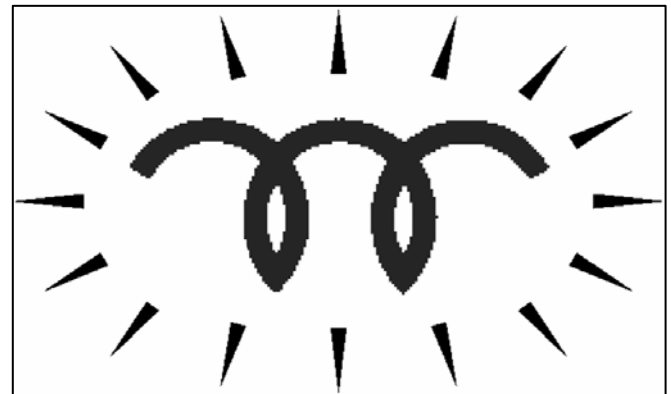
##### NOTE 2:

For 7/2007 built models onwards, only use CONSULT III. CONSULT II will display unusual DTC's.



#### 10. Glow Plugs Activated Indicator Light (ORANGE)

This light will illuminate when the ignition is switched on. It indicates to the driver that the glow plugs are active (warming up the engines combustion chamber). It is desirable to wait until this light goes out prior to starting the engine. Once the engine is running the light will remain off although in many cases the glow plugs remain active for a period of time dependant on engine temperature.



#### SPECIAL NOTE:

##### Water in Fuel Filter Warning (ORANGE)

This light is NOT operated by the ECM. It is permanently powered by the instrument cluster & it is illuminated when it is grounded by the water sensor in the base of the Fuel Filter.

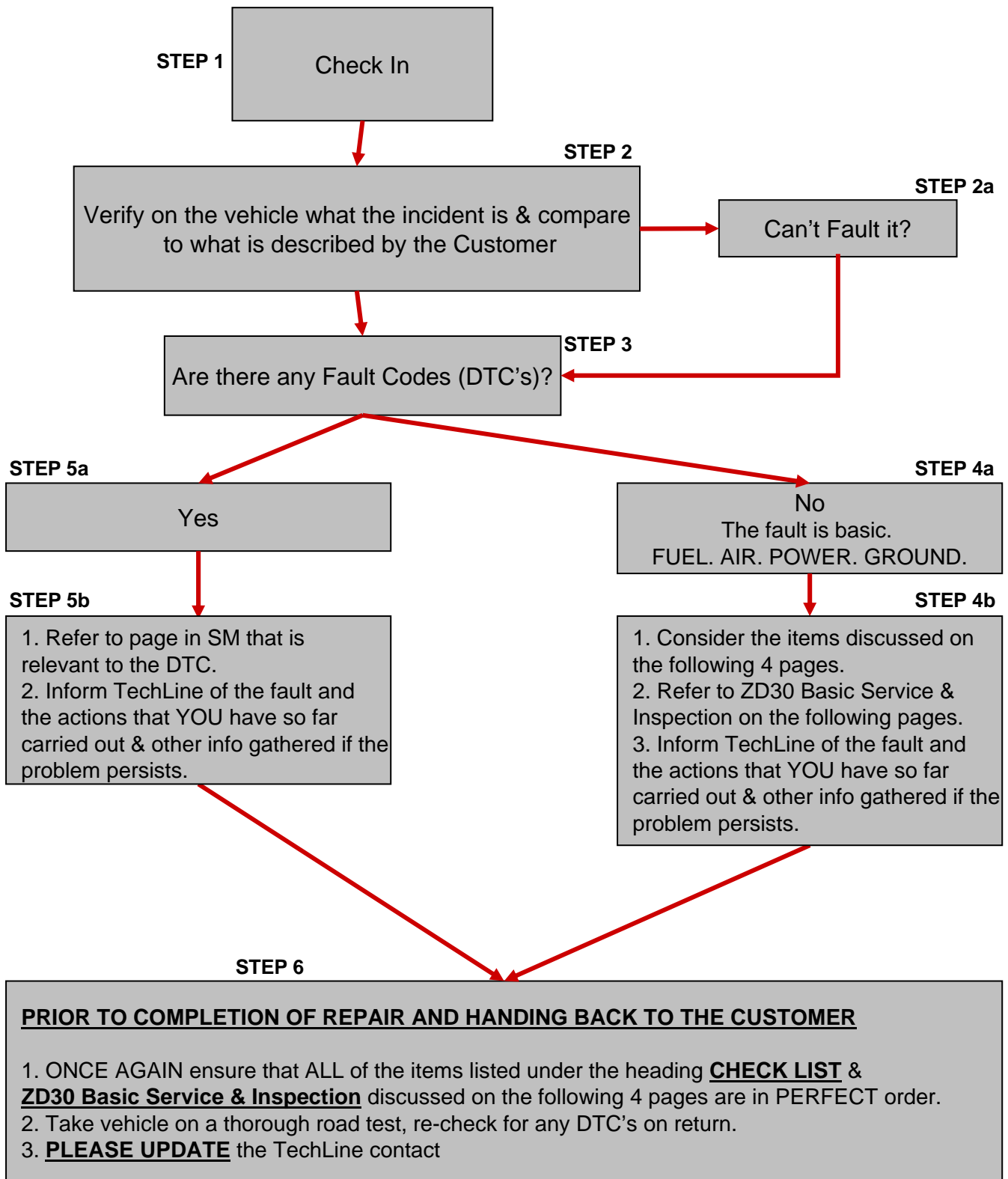
There will be NO DTC's logged when the water sensor in the base of the Fuel Filter is grounded. However if the water in fuel situation is not amended, engine related DTC's will eventually be logged due to water damaging the FUEL SYSTEM components.

Refer to page 70 for more detail.



For Non CRD ZD30 engines (2000 ~ 2006MY), the MIL also acts as the "Water In Fuel" warning light. There will be no DTC's logged in the case of Water in Fuel for this model.

## ZD30 ENGINE TROUBLE DIAGNOSIS



## ZD30DDTi Engine Trouble Diagnosis

### Checklist - DON'T FORGET THE BASICS!!!

#### 1. FUEL

- (a) Is there sufficient QUANTITY of Fuel being delivered to the pump? Blocked Filter or Lines?
- (b) Is there an acceptable QUALITY of Fuel being delivered to the Pump? Drain base of Filter & check for contaminated Fuel + Dirt &/or Water. Check for PETROL as well.
- (c) Question the customer about their fuel purchasing habits etc.
- (d) Is there air leaking into fuel prior to it reaching the pump?

**## Take a sample of Fuel & store it in a clean – air tight – container for future reference ##**

#### 2. AIR

- (a) Is there sufficient QUANTITY of Air being delivered to the Engine? Blocked Air Filter or Air Intake system? Faulty Air Intake Control Valve (ETC)? Air Leaks between MAFS & Engine?
- (b) Is there an acceptable QUALITY of Air being delivered to the Engine? EGR valve stuck open? Refer to "EGR FUNCTION" check in section EC of the Service Manual.
- (c) Check that Exhaust System is not blocked
- (d) Check the Turbo Unit. Refer to "TC SYSTEM" check in section EC of the Service Manual. Ensure there is a sufficient vacuum supply coming from the engine driven vacuum pump. Also refer to "TURBO CHARGER" checks in section EM of the Service Manual.
- (e) Check the Engine COMPRESSION with a KNOWN GOOD compression gauge. WRITE down the figures you measured. Follow the directions in section EM of the Service Manual.
- (f) Check that the "Crankcase Ventilation System" as per the information in section EC ("ENGINE CONTROL SYSTEM") of the Service Manual

#### 3. POWER & GROUNDS (More detail on pages 58 - 59)

- (a) Check the Battery. Is it serviceable? Does the condition improve with a jumper battery connected?
- (b) Confirm the cranking speed (if no start). The engine should crank at a speed of at LEAST 160rpm. Use "DATA MONITOR" & view the CKPS in CONSULT to verify the Engine Cranking Speed.
- (c) Check ALL of the Ground points, Battery Terminals Fuses & Fusible links that relate to the ENGINE SYSTEM. Carry out the "POWER SUPPLY AND GROUND CIRCUIT" checks in section EC of the Service Manual.

#### 4. SERVICE, OTHER WORK & REPAIRS HISTORY

- Is the Engine Oil Level OK? Too Full? Too Low?
- Is it Due / Overdue for a Service?
- Is the Engine Oil type correct? (Is it **10W 40 ACEA B3**?) The wrong type of Engine Oil can cause **Poor Fuel Consumption / Lack of power issues**. Thoroughly investigate the Service History.
- Is it fitted with **NON GENUINE ACCESSORIES**? Accessories which have been poorly / incorrectly fitted? Particularly electrical ones?

## ZD30DDTi Engine Trouble Diagnosis

### Checklist Continued

#### 5. BASIC SERVICE ITEMS

Review the “Basic Service & Inspection” on the following pages. Carry out the inspection as part of any trouble diagnosis activity. (Some of the items may not be necessary given the type of problem in question)

#### 6. ILLOGICAL INPUTS INTO THE ECM

(a) Whilst being driven as well as stationary, ensure that inputs such as “P/N Posi Sw” & “Brake Sw” are input correctly. For a complete reference list, refer to section EC - “TROUBLE DIAGNOSIS – CONSULT II Reference Value in Data Monitor Mode” of the Service Manual.

(b) If possible, drive the vehicle fitted with a “KNOWN GOOD” Mass Air Flow Sensor.

#### 7. ENGINE MECHANICAL TIMING INDICATION SYSTEM.

Is the Engine’s Static Timing OK? (Valve timing etc.) Timing Chains & associated drive components & CKPS / CMPS indication devices OK? Excessive or Insufficient Valve Clearances? Also refer to Check Item “2. Air” on the previous page.

#### 8. NATS

Are all of the Keys working? Is there a foreign Electronic device on the Key Ring Set? Are the keys genuine parts? The RED LED on top of the dash pad (drivers side) will illuminate if there is a NATS related issue, however this is NOT always the case.

## ZD30DDTi Engine Trouble Diagnosis

### ZD30 Basic Service & Inspection

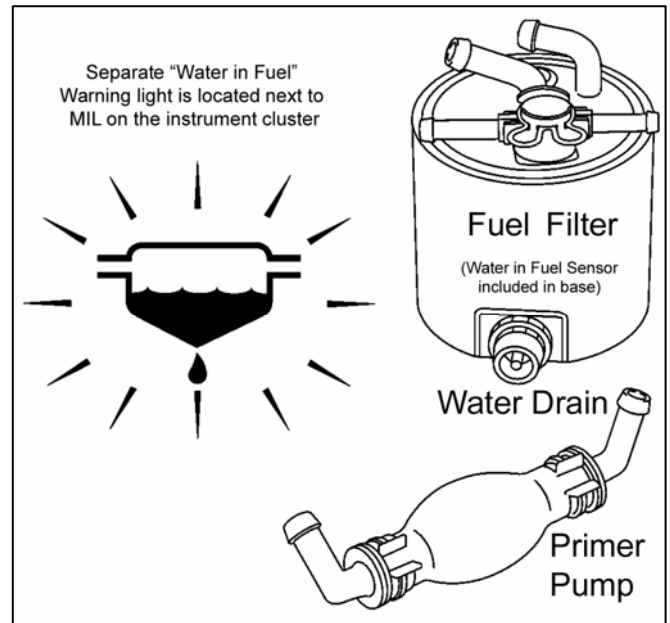
#### 1. Fuel Filter, Bleeding & Water Drain

For ALL DIESEL ENGINE VEHICLES, Ensure that the fuel filter is drained EVERY 10,000KM'S!

If water collects in the base of the filter, the Water in Fuel warning light will illuminate to warn the driver of the water in fuel condition. There will be no DTC's recorded in the ECM however.

DTC's will eventually be logged if the water in fuel condition is not quickly rectified.

Refer to page 69 for more detail.

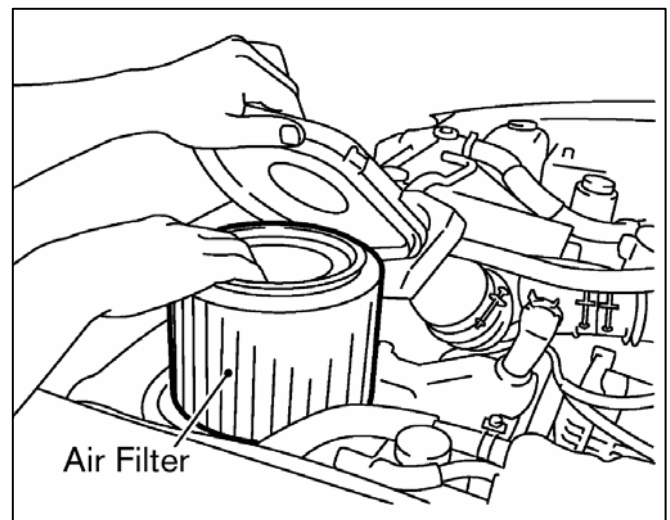


#### 2. Air Filter & Inspection of Air Intake

Ensure the Air Filter is serviceable. If it is lightly dusted it can be cleaned with compressed air as the element is a dry paper type. Other wise it should be replaced.

Ensure the remainder of the air intake system (such as the intercooler) is free from;

- Blockage
- Leakage
- Damage



#### 3. DTC Inspection

Using CONSULT, check for any DTC's in ENGINE as well as any other system. PRINT OFF ANY DTC's RECORDED IMMEDIATELY prior to taking any further action.

Refer to the ESM for information about the codes. Refer to the list of "Possible Causes" to determine the MOST LIKELY cause of the fault.

REMEMBER THE CODE COULD BE RELATED TO THE BASICS! Do NOT immediately blame expensive components.

#### NOTE:

For 7/2007 onwards built models, only use CONSULT III.



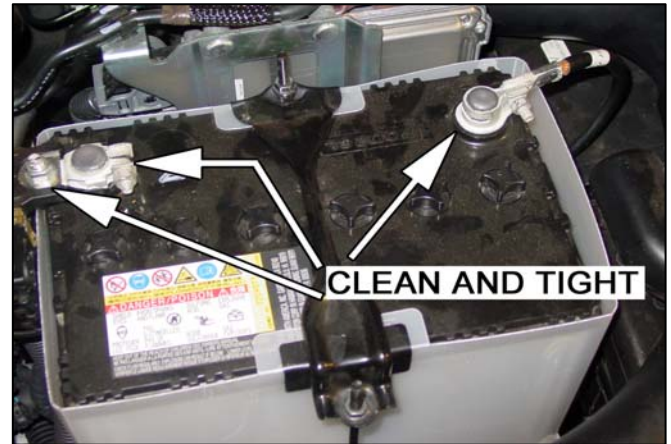
## ZD30DDTi Engine Trouble Diagnosis

### ZD30 Basic Service & Inspection

#### 4. Battery / Alternator / GROUNDS

Given the engine's high reliance on ELECTRICAL POWER, ensure that the source of this is in perfect order.

- Clean / tight battery terminals
  - Battery can pass a load test
  - Alternator is charging properly - WHEN IT IS UNDER LOAD
  - Engine ground connections F8, F9.
- REFER TO PAGES 58 – 59 OF THIS MANUAL FOR MORE DETAIL.

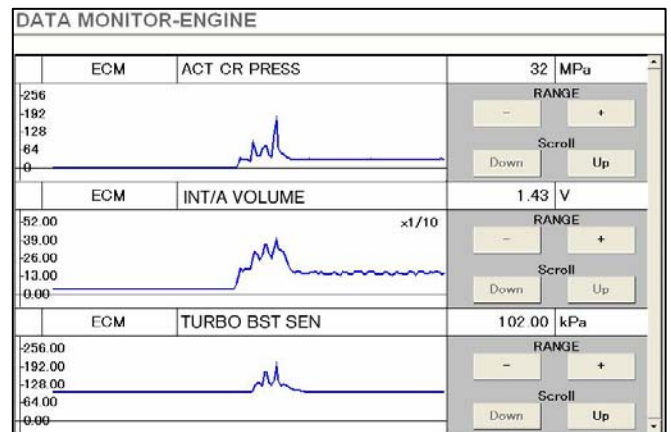


#### 5. Fuel Pressure

Use CONSULT in ENGINE – DATA MONITOR – ACT CR PRESS to determine the amount of fuel pressure in the rail.

**Do NOT loosen a fuel line at the injector or rail!**

REFER TO PAGE 14 OF THIS MANUAL FOR MORE DETAIL.

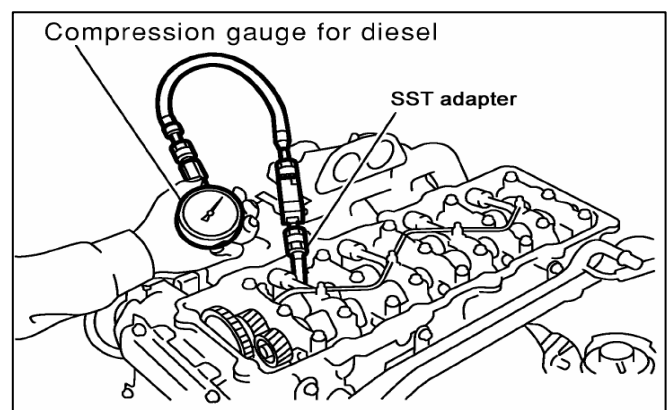


#### 6. Turbo Boost Pressure / Mass Air Flow

Use CONSULT III in ENGINE – DATA MONITOR – INT/A VOLUME & TURBO BOOST SEN to determine the amount of air pressure (turbo boost) & airflow in the intake when the engine is starting, raced, under load. REFER TO PAGE 46 OF THIS MANUAL FOR MORE DETAIL.

#### 7. Engine Compression

Ensure that there is suitable compression. Follow the directions outlined in section EM of the Service Manual.

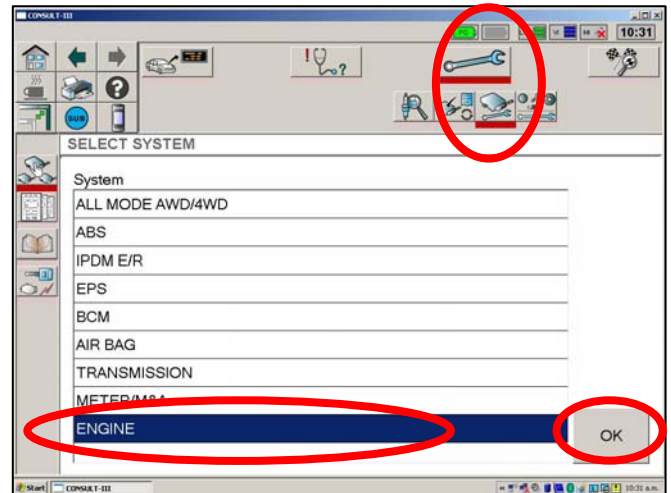


## ZD30DDTi Engine Trouble Diagnosis

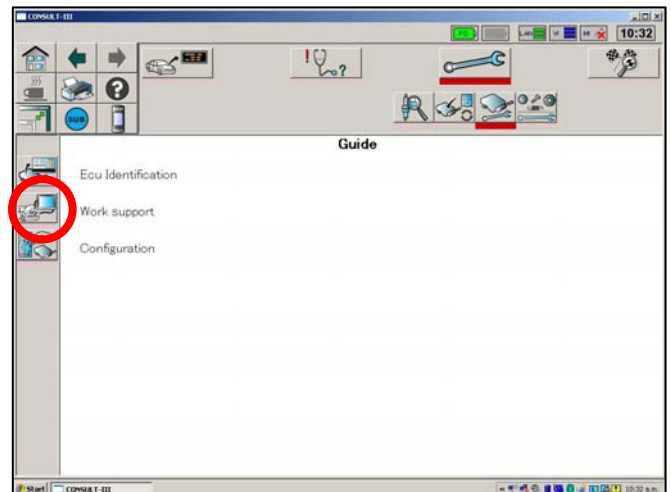
### CONSULT III Work Support

#### 1. Access to WORK SUPPORT

- Touch the spanner icon & then select the smaller spanner / ECU icon at the top of the screen on CONSULT III.
- Highlight ENGINE
- Touch OK



- Touch the icon adjacent to the word "Work Support"



#### 2. Selection of Required Work Support Operation

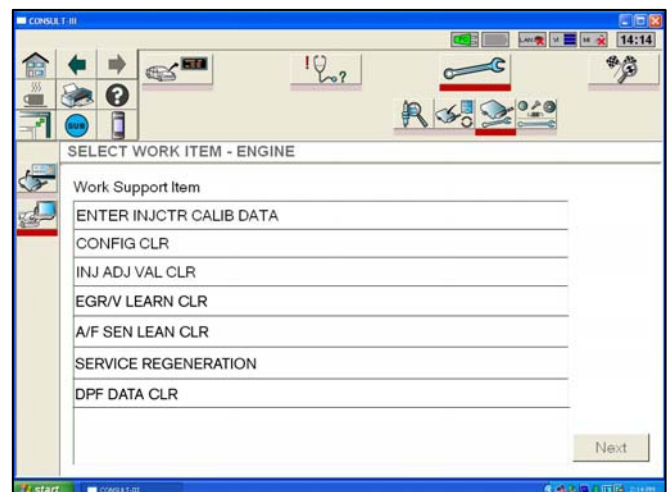
Select (highlight) the desired Work Support operation & then touch "Next"

Refer to the chart on the following page as well as section EC – BASIC SERVICE for further instruction regarding these operations.

In most cases the on screen instructions will guide you further.

#### SPECIAL NOTE:

The screen shown right is an example screen only.



## ZD30DDTi Engine Trouble Diagnosis

### ZD30 CONSULT II or III Basic Service

#### 1. Injector Adjustment Value Registration

Each Injector will tend to have very slight differences between them with the amount of Fuel they deliver when an electrical current is applied to them.

If the ECM was to apply exactly the same current to all 4 x injectors on the Engine, there will tend to be slight differences in the amount of Fuel each Injector delivers.

Therefore once the Injector has been manufactured, a special resistance measurement is taken of the Injector. This measurement is converted into a special code & then printed on the top of the Injector. This code is entered into the ECM at the factory via a special scan tool.

However if during service, 1 or more than 1 of the injectors are replaced, the code of the failed injector needs to be erased from the ECM & the code of the newly installed injector will need to be entered into the ECM. This operation is can be carried out easily using CONSULT II.

If the ECM is replaced, the codes of the already existent Injectors need to be entered into the ECM.

1. Turn ignition switch ON (engine stopped).

|                         |  |
|-------------------------|--|
| SELECT WORK ITEM        |  |
| ENTER INJCTR CALIB DATA |  |
|                         |  |
|                         |  |
|                         |  |
|                         |  |
|                         |  |
|                         |  |
|                         |  |
|                         |  |

2. Select "ENTER INJECTOR CALIB DATA" in "WORK SUPPORT" mode with CONSULT-II.

|                                 |  |
|---------------------------------|--|
| ENTER INJCTR CALIB DATA         |  |
|                                 |  |
| IGNITION ON AND ENGINE STOPPED. |  |
|                                 |  |
| START                           |  |

3. Touch "START".

|                         |        |
|-------------------------|--------|
| ENTER INJCTR CALIB DATA |        |
|                         |        |
| SET VALUE               |        |
| CYL1                    | 1F6V1A |
| CYL2                    | C1TGMF |
| CYL3                    | A2ZSD3 |
| CYL4                    | 4CDF58 |
|                         |        |
| CYL1                    | CYL2   |
| CYL3                    | CYL4   |
| END                     | START  |

4. Select the number of the cylinder which needs Injector Adjustment Value Registration.

|          |       |     |       |   |
|----------|-------|-----|-------|---|
| KEYBOARD |       | HEX |       |   |
| 71FZ61   |       |     |       |   |
|          | A     | B   | C     | D |
|          | 7     | 8   | 9     | E |
|          | 4     | 5   | 6     | F |
|          | 1     | 2   | 3     |   |
| <<       | >>    | 0   | 00    |   |
| CLEAR    | BKSPC |     | ENTER |   |

5. Input injector adjustment value, and touch "ENTER".

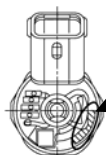
|                         |        |
|-------------------------|--------|
| ENTER INJCTR CALIB DATA |        |
|                         |        |
| SET VALUE               |        |
| CYL1                    | 71FZ61 |
| CYL2                    | C2TCME |
| CYL3                    | A1FS3B |
| CYL4                    | 4CA7D9 |
|                         |        |
| CYL1                    | CYL2   |
| CYL3                    | CYL4   |
| END                     | START  |

6. Repeat step 4 - 5 till there is no cylinder which needs Injector Adjustment Value Registration, and touch "START".

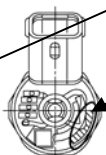
|                         |        |
|-------------------------|--------|
| ENTER INJCTR CALIB DATA |        |
| CMND FINISHED           |        |
| SET VALUE               |        |
| CYL1                    | 71FZ61 |
| CYL2                    | C2TCME |
| CYL3                    | A1FS3B |
| CYL4                    | 4CA7D9 |
|                         |        |
|                         |        |
|                         |        |
|                         |        |

7. After "CMND FINISHED" is displayed, make sure that the following values are same for each cylinder.

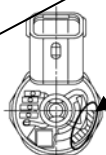
- Injector adjustment value which is printed on a injector.
- Injector adjustment value which is displayed on CONSULT-II screen.



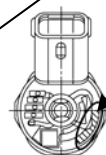
CYL 1



CYL 2



CYL 3



CYL 4

**Ensure the codes on CONSULT II screen match the code printed on top of each Injector**



## ZD30DDTi Engine Trouble Diagnosis

### ZD30 CONSULT II or III Basic Service

#### 2. EGR Volume Control Valve Closed Position Learning Value Clear

If the following actions regarding the EGR valve have been carried out;

- EGR volume control valve is removed
- EGR volume control valve is replaced

This operation using CONSULT in WORK SUPPORT must be carried out to ensure proper operation of the EGR valve.

Please refer to section EC - Basic Service Procedure in the Service Manual for more detail.

#### 3. EGR Volume Control Valve Closed Position Learning

If the following actions regarding the EGR valve have been carried out;

- EGR volume control valve is removed.
- EGR volume control valve is replaced.
- ECM is replaced

This operation must be carried out to ensure proper operation of the EGR valve.

This is much like the Accelerator Pedal & Throttle Valve learning operation on Petrol engine models with Electric Throttle. It is a simple matter of operating the ignition key within set time periods.

Please refer to section EC - Basic Service Procedure in the Service Manual for more detail.

|                         |
|-------------------------|
| <b>SELECT WORK ITEM</b> |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |
| <b>EGRV LEARN CLR</b>   |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |

This screen in CONSULT II is located by 1<sup>st</sup> selecting **ENGINE** & then selecting **WORK SUPPORT**.

## ZD30DDTi Engine Trouble Diagnosis

### ZD30 CONSULT II or III Basic Service

#### 4. Throttle Valve Closed Position Learning Value Clear

Throttle valve closed position learning value should be cleared after the following actions regarding the Electric Throttle Control valve have occurred;

- Electric throttle control actuator is removed.
- Electric throttle control actuator is replaced.

Please refer to section EC - Basic Service Procedure in the Service Manual for more detail.

#### 5. Throttle Valve Closed Position Learning

Throttle Valve Closed Position Learning is an operation to learn the fully closed position of the throttle valve by monitoring the throttle position sensor output signal.

It must be performed each time any of the following actions have occurred;

- Electric throttle control actuator is removed.
- Electric throttle control actuator is replaced.
- ECM is replaced.

This is much like the Accelerator Pedal & Throttle valve learning operation on Petrol engine models with Electric Throttle. It is a simple matter of operating the ignition key within set time periods.

Please refer to section EC - Basic Service Procedure in the Service Manual for more detail.

|                         |
|-------------------------|
| <b>SELECT WORK ITEM</b> |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |
| <b>TP POS LEARN CLR</b> |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |
| <b>XXXXXXXXXX</b>       |

This screen in CONSULT II is located by 1<sup>st</sup> selecting **ENGINE** & then selecting **WORK SUPPORT**.

## ZD30DDTi Engine Trouble Diagnosis

| BASIC SERVICE OPERATION APPLICATION CHART  |  |                                    |   |   |  |  |
|--|--|------------------------------------|---|---|--|--|
| Basic Service Operation<br>Required Repair   | EGR Valve Position Learn Clear (CONSULT)   | EGR Valve Closed Position Learning | Throttle (ETC) Valve Position Learn Clear (CONSULT) | Throttle (ETC) Valve Closed Position Learning | Injector Adjustment Value Registration (CONSULT) | Reprogram ALL NATS Ignition Keys to vehicle (CONSULT with NATS Software) |
| Replace ECM with Brand New Unit  | NO   | YES                                | NO  | YES   | YES  | YES  |
| Be sure of the EXACT REASON why the ECM is to be replaced. Discuss with TechLine to be sure. |  |                                    |   |   |  |  |
| Replace / Swap / Remove & Refit Throttle (ETC) Unit  | NO   | NO                                 | YES   | YES   | NO   | NO   |
| Replace / Swap / Remove & Refit EGR Valve unit   | YES  | YES                                | NO  | NO  | NO   | NO   |
| Fit new / Other Injectors  | NO   | NO                                 | NO  | NO  | YES  | NO   |
| Fit new / Other Fuel Pump  | No Special operations are required. Ensure that the Fuel System has been thoroughly flushed prior to the fitment of these new components.<br>The most common reason why a pump, rail or injectors are replaced is contaminated fuel. |                                    |   |   |  |  |
| Fit new / Other Fuel Rail Assembly   |  |                                    |   |   |  |  |

### Summary of Basic Service Operations

This chart quickly summarises all typical repair tasks that could possibly be required on a ZD30 CRD engine.

Locate the repair or repairs that were carried out on the vehicle in the left side column. Once located, refer to what Basic Service Operations are required to be carried out to support the original repair.

Failure to properly complete the repair & replacement procedure could easily result in an unsuccessful repair or a repeat failure.

## ZD30DDTi Engine Trouble Diagnosis

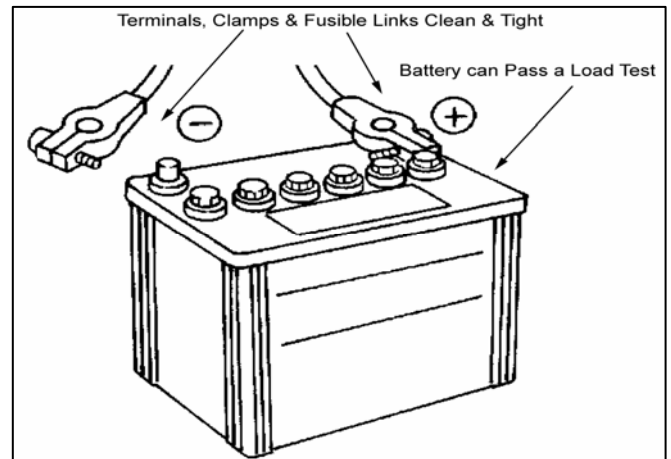
### Power & Grounds

#### 1. Battery

Ensure that the Battery is in GOOD CONDITION. Is it able to cope under load? Carry out a load test on it to be sure.

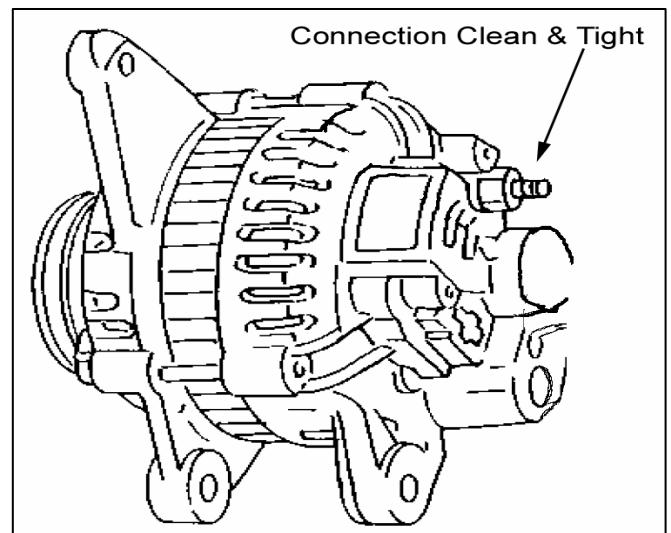
Ensure the POS & NEG terminals are CLEAN & TIGHT. Remove & inspect them closely to be sure.

Make sure the fusible links on the positive terminal are not corroded.



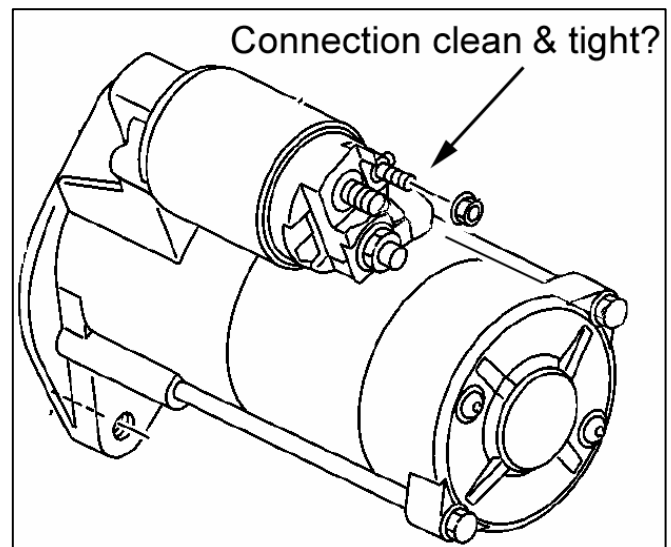
#### 2. Alternator

Is the Alternator outputting a decent charge? Operate all electrical accessories to ensure the Alternator can cope under a loaded condition. Ensure the connections on the rear of the Alternator are Clean & Tight.



#### 3. Starter Motor

Even though it may appear that the Starter Motor is functioning correctly, ensure that the main cables connected to it are Clean & Tight.



## ZD30DDTi Engine Trouble Diagnosis

### Power & Grounds (Cont'd...)

#### 4. ECM Relay

The ECM Relay provides power to the ECM so that the Injectors can operate as well as all the other Engine Control components.

#### 5. Engine System Ground

Ensure that ALL of the Ground Points shown right are in GOOD CONDITION.

Ensure they are Clean & Tight.

**Remember:** The ECM outputs an EXTREMELY HIGH CURRENT to operate the Injectors. Therefore a GOOD GROUND connection is very important for reliable engine operation.

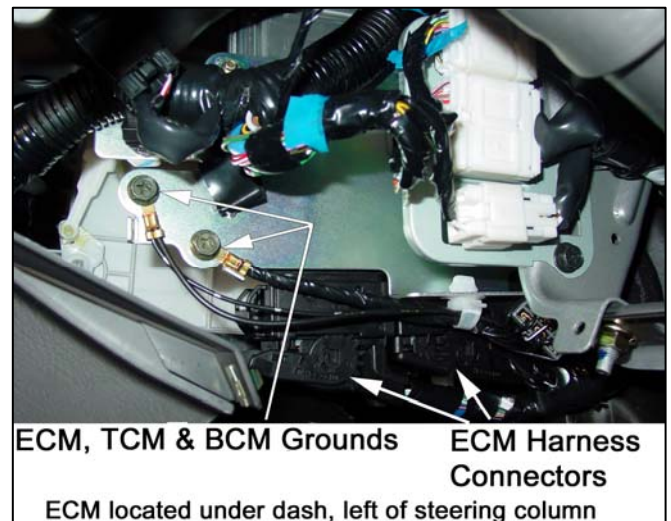
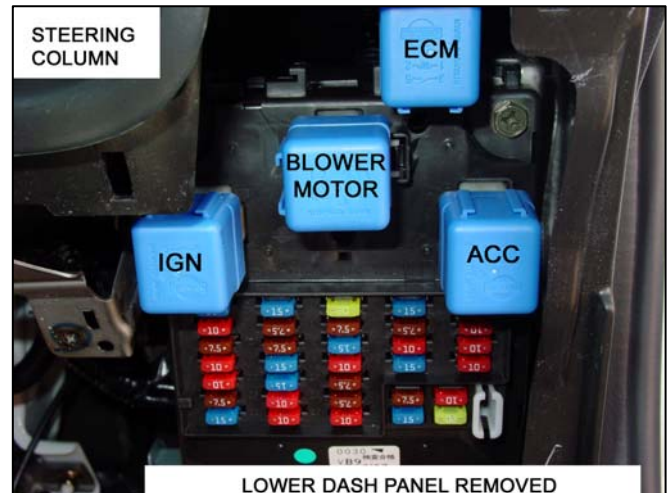
#### NOTE:

There are NO actual Ground connections on the Engine assembly. All Engine Grounds are connected to the body in the 1 location shown right.

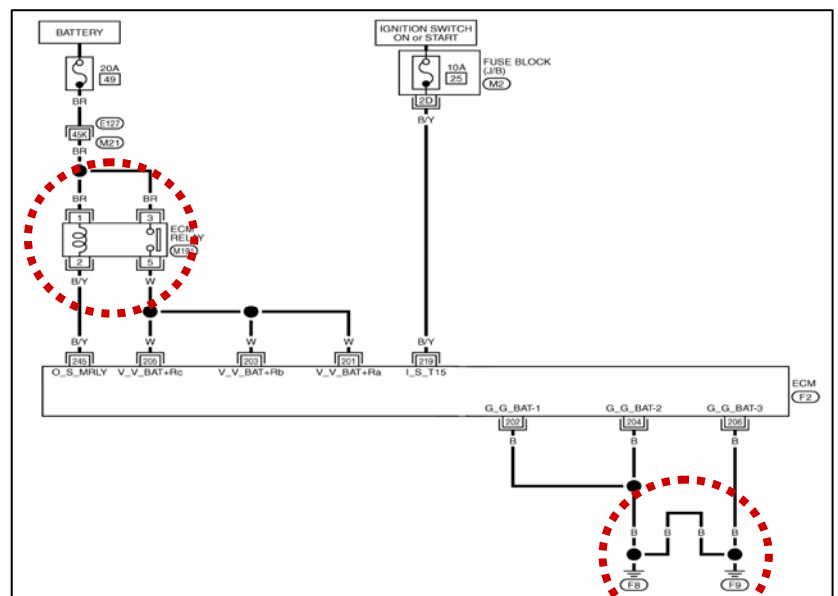
ENGINE, TRANSMISSION & BODY CONTROL MODULE GROUNDS are located on the ECM Bracket under the dash, drivers side, left of the Steering Column.

#### SPECIAL NOTE REGARDING GROUND CONNECTIONS:

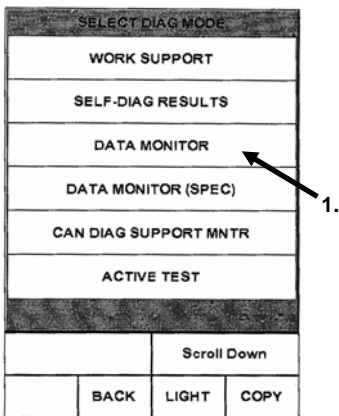
The body is NOT grounded to the chassis on any Y61 model. Ensure it has an additional "Body to Chassis" Ground connection if the vehicle has additional accessories installed.



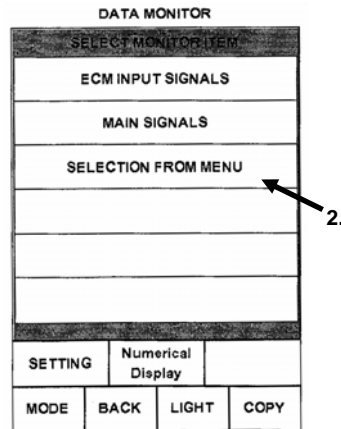
**THOROUGHLY CHECK THE 2 X CIRCLED ITEMS PRIOR TO ECM SWAP OR REPLACEMENT!**



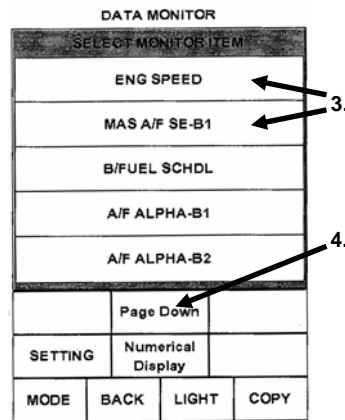
## CREATING DATA MONITOR GRAPHS WITH CONSULT II



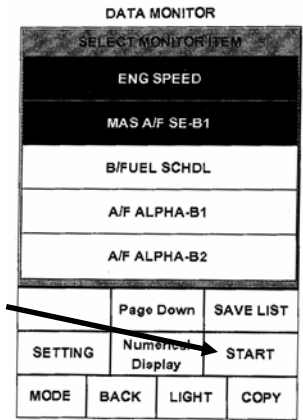
1. Touch;  
DATA MONITOR



2. Touch;  
SELECTION FROM MENU.  
(Otherwise touch MAIN SIGNALS and then START for general items.)

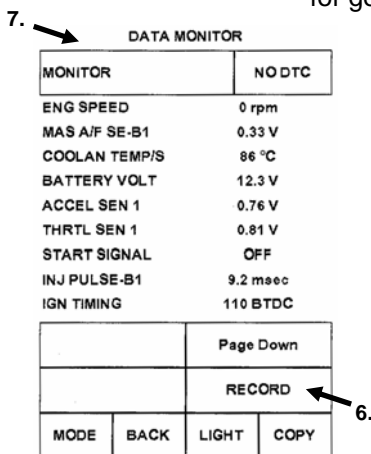


3. Touch the items you would like to view / record.  
4. Touch PAGE DOWN to see other items for selection.

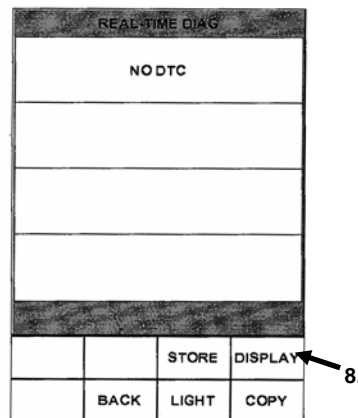


Each selected item is highlighted.

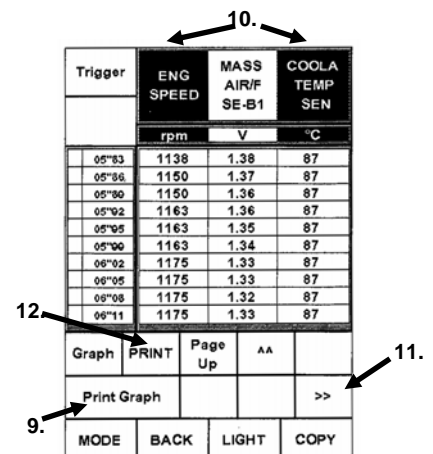
5. Then touch START



6. Touch RECORD at the desired moment.  
7. The timer begins count-down to 0% from 100% (not shown in pic)



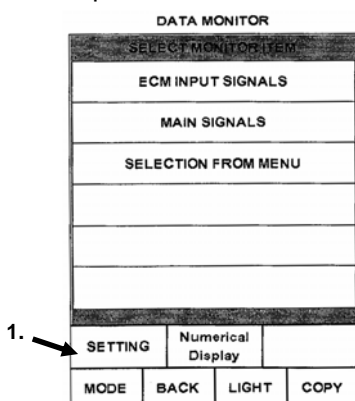
Once count down to 0 is complete, above screen is automatically displayed.  
8. Touch; DISPLAY



9. Touch until "Print Graph" is displayed.  
10. Touch items that require graphing.  
11. Touch double arrow to reveal other recorded items.  
12. Touch "Print". Printer will output graphs as shown over page.

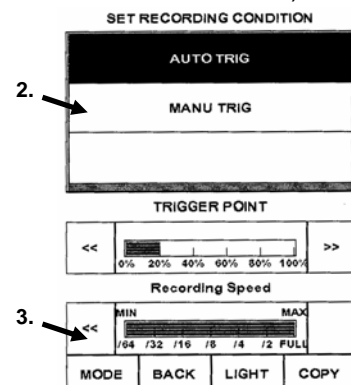
### SETTING TO "MANU TRIG"

(This is required if there is a DTC logged & cannot be cleared. Otherwise CONSULT II will "AUTO" record)



If a situation arises where a known DTC will automatically trigger AUTO RECORD, the machine can be set for MANUAL RECORD regardless of DTC or not.

1. Touch; SETTING  
2. Touch; MANU TRIG.  
3. (ONLY if required) Touch the double arrows to slow down the time the recording is taken.



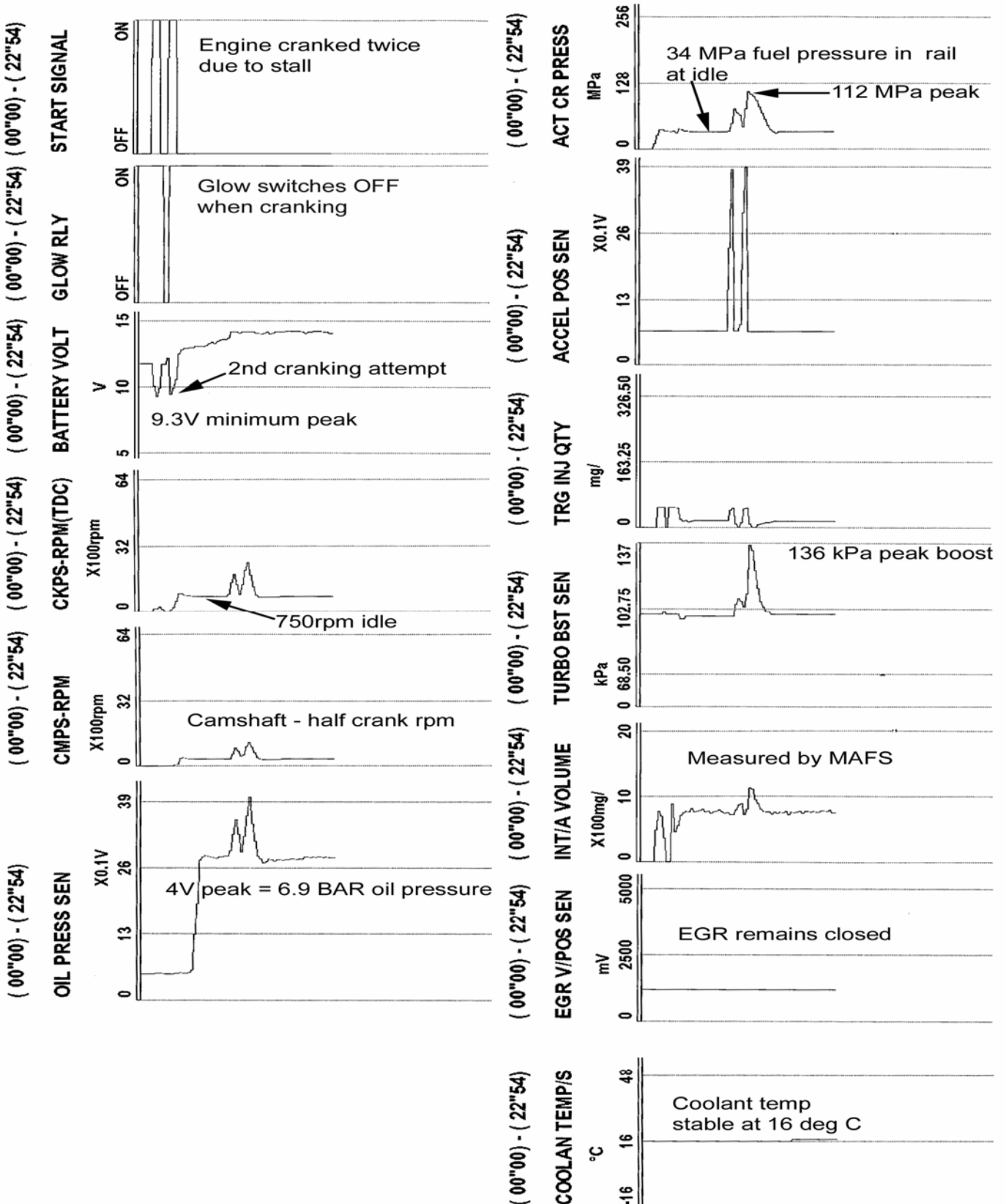
# NISSAN Learning Academy

ZD30DDTi CRD Engine

Nissan Australia July 2008

## ENGINE COLD START CRANKING TEST – Y61 ZD30 CRD M/T. (Engine Normal).

With Ign ON, “Record” touched on CONSULT II, then engine cranked, engine then stalled so it was re-cranked, engine started & allowed to idle, then & engine raced twice.



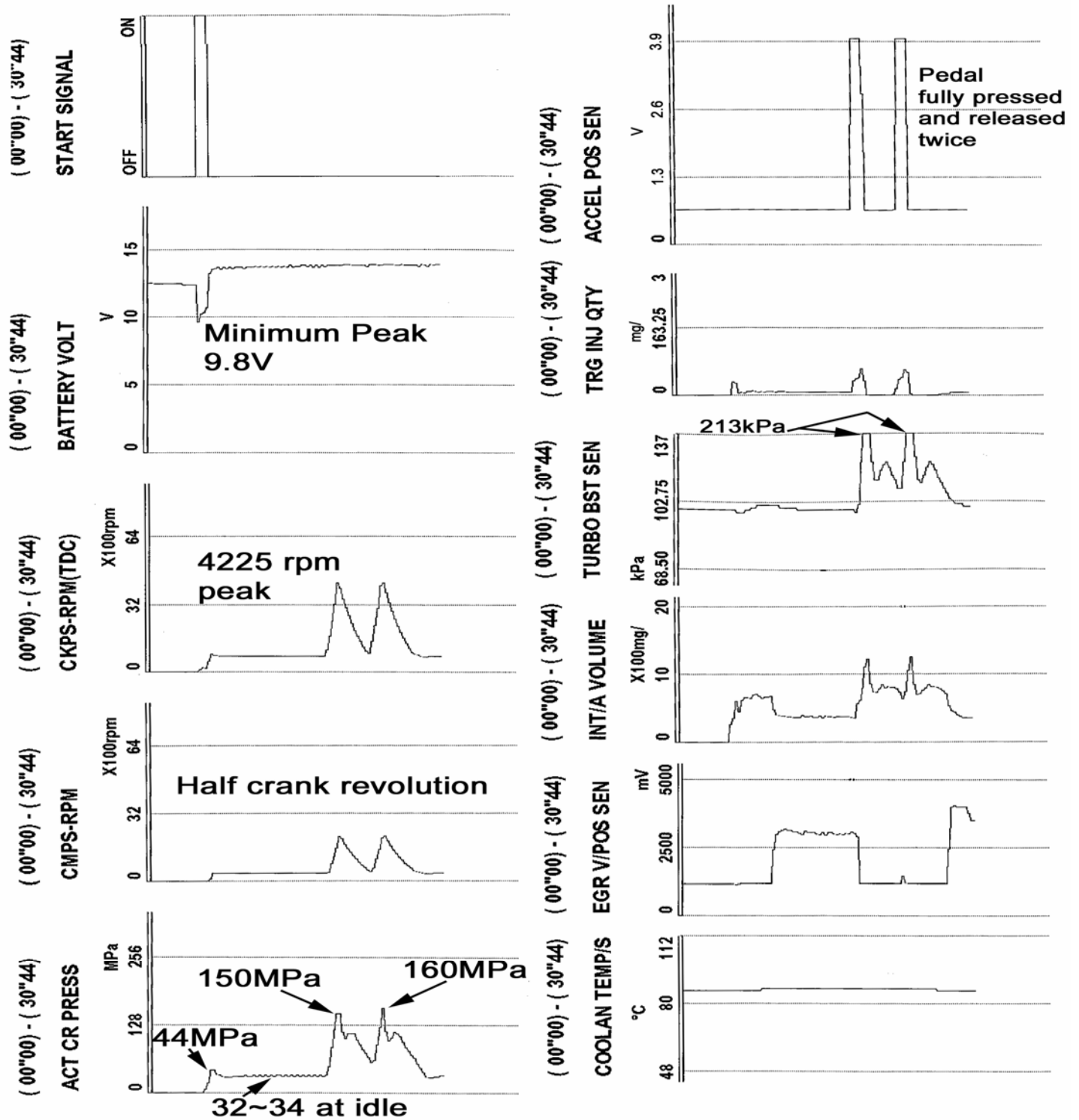
# NISSAN Learning Academy

ZD30DDTi CRD Engine

Nissan Australia July 2008

## ENGINE HOT START CRANKING TEST – Y61 ZD30 CRD M/T. (Engine Normal).

With Ign ON, “Record” touched on CONSULT II, then engine cranked, started & allowed to idle, then & engine raced twice.





# NISSAN Learning Academy

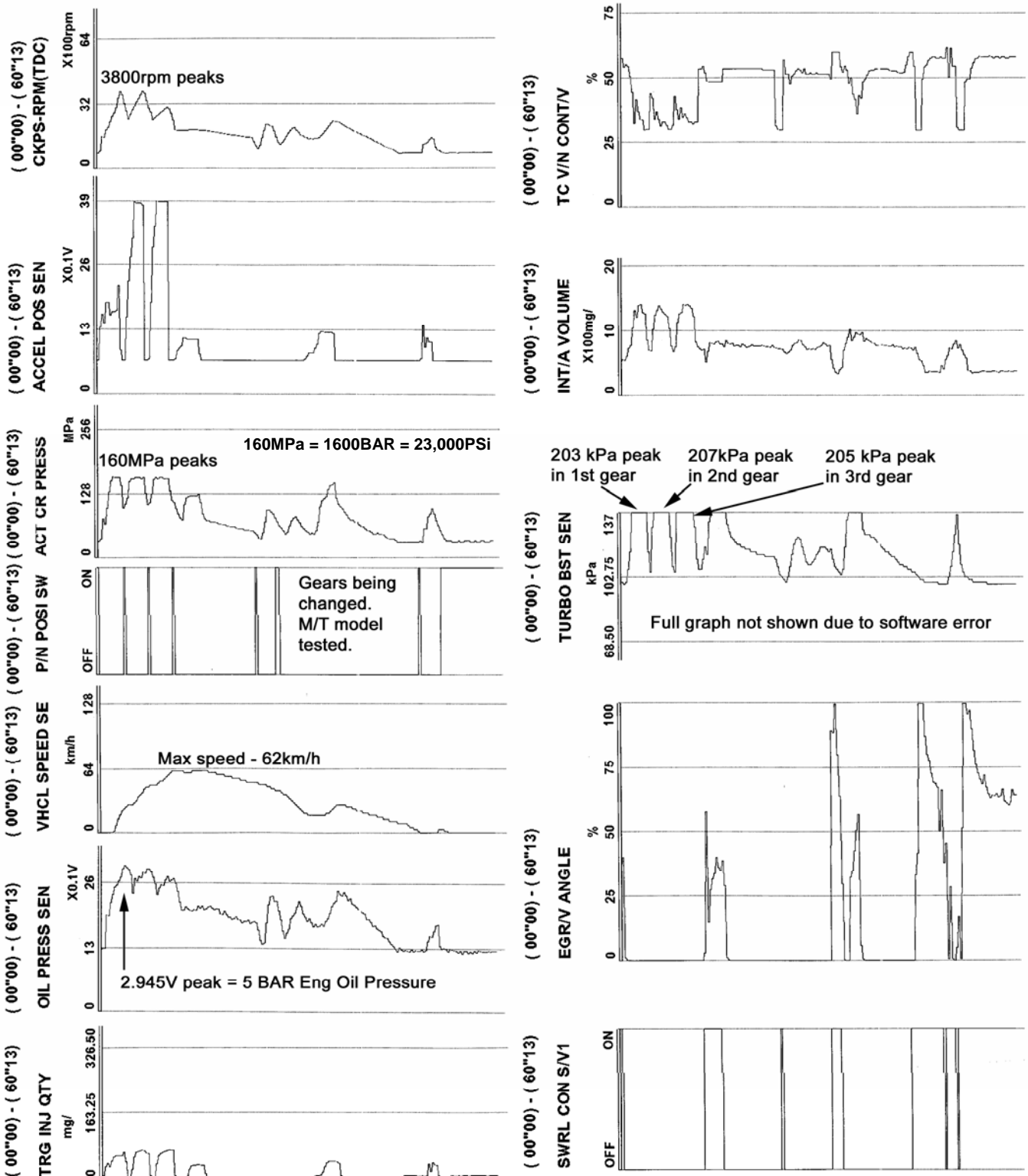
ZD30DDTi CRD Engine

Nissan Australia July 2008

DRIVE TEST – Y61 ZD30 CRD M/T. (Recorded over a period of 1 minute).

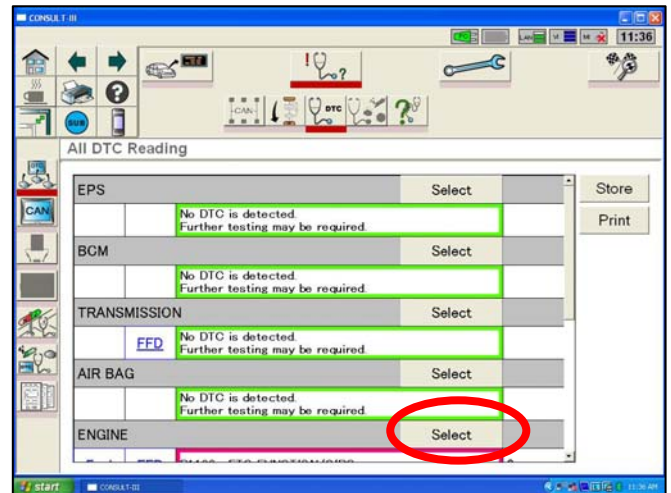
Engine already idling & already in 1<sup>st</sup> gear, “Record” touched on CONSULT II, then driven changing through all gears (from 1<sup>st</sup>, then 2<sup>nd</sup>, 3<sup>rd</sup> & finally 4<sup>th</sup>) until vehicle speed reached 62km/h. Then slowed down changing back gears & eventually brought to a stop.

NOTE: Engine was already at operating temperature. (Approximately 88 deg C)

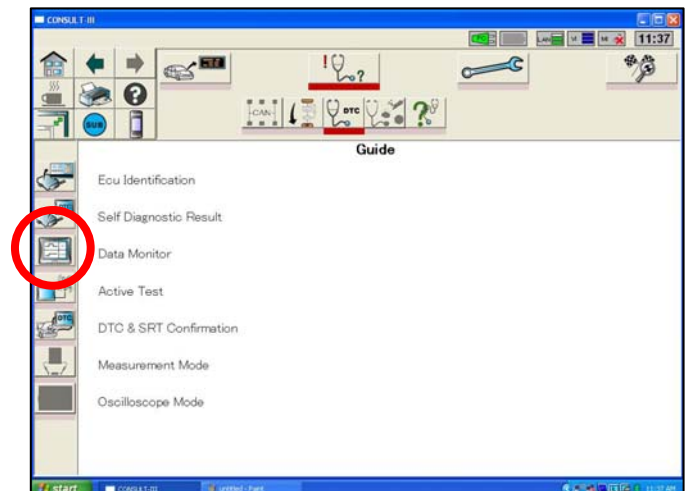


## CONSULT III DATA MONITOR RECORD

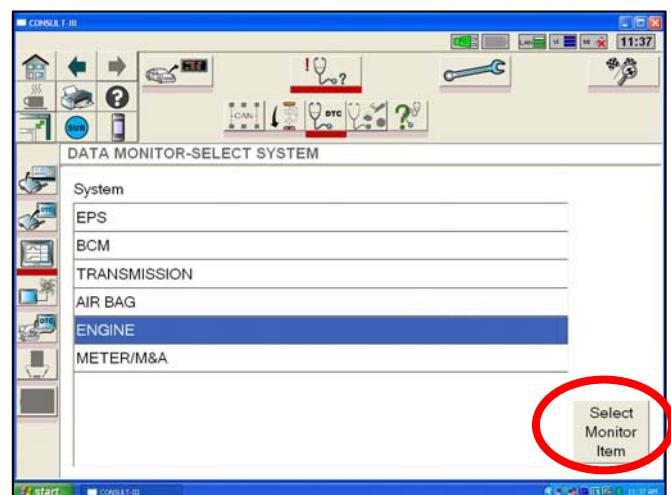
1. Touch the word **“Select”** against the desired vehicle system.



2. Touch the **“Data Monitor”** icon on the left of the screen



3. Highlight **“ENGINE”** & then touch **“Select Monitor Item”**



## CONSULT III DATA MONITOR RECORD

4 (i) Clear the pre selected Main Signals items by touching “**Clear Monitor Item**”.

(ii) Highlight the desired items from the list on the screen. These are **examples**;

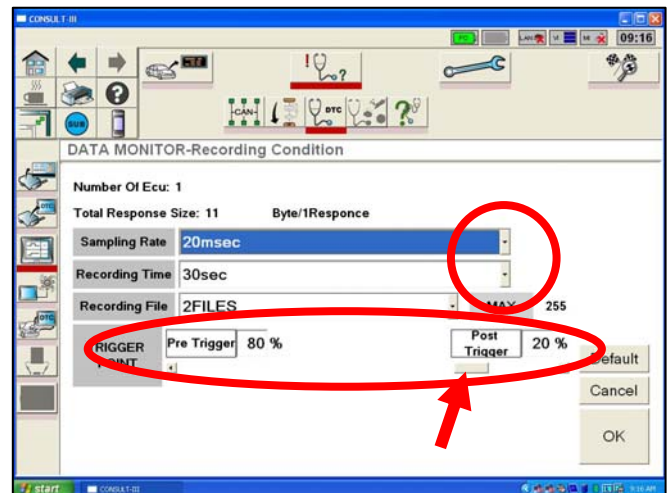
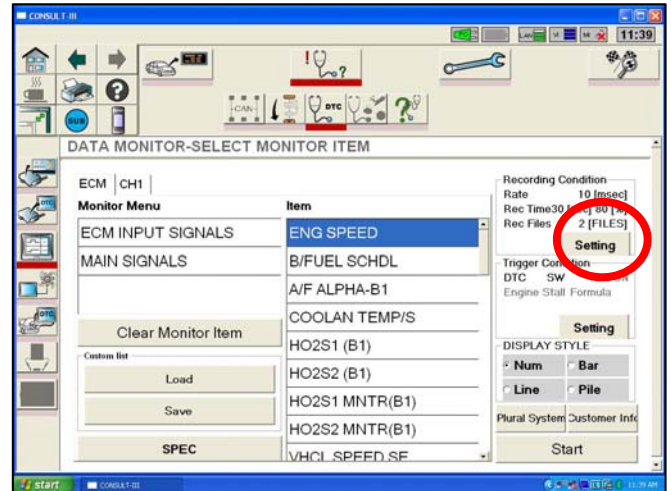
- ENG SPEED
- BATTERY VOLT
- ACCEL SEN 1
- T P SEN 1
- TURBO BST SEN 1
- START SIGNAL

(iii) Touch the “**Setting**” tab (circled right).

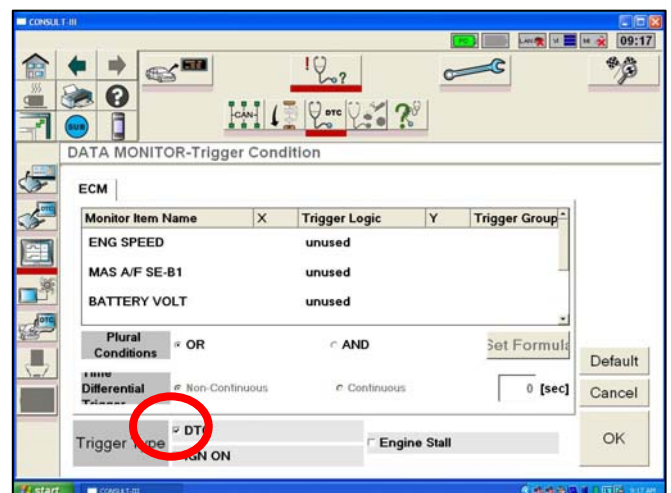
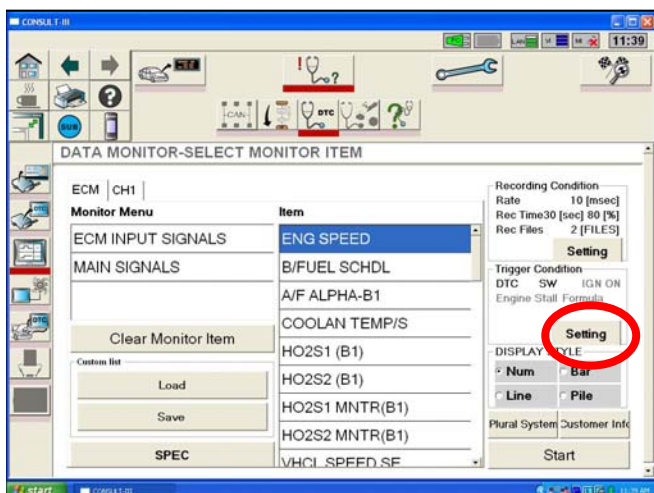
(iv) Ideally the “Sampling Rate” should be slowed down from every 10ms to every 20ms. This can be done by selecting the drop down icon. (small circle). There maybe cases where the recording time needs to be extended. Otherwise leave set to 30 seconds so as not to make the graphs too large.

(v) In most cases it is will not be necessary to adjust the trigger point. Leave it set to 80% post & 20% pre. (large circle / arrow)

(vi) Touch “**OK**” on the bottom right of the screen & then touch “**Start**” once the screen returns to the “**SELECT MONITOR ITEM SCREEN**”



The 2<sup>nd</sup> setting tab accesses the recording trigger condition settings. Un-select the DTC box if the ECM has a permanent DTC in it. Otherwise the recording will automatically start as a DTC is detected.



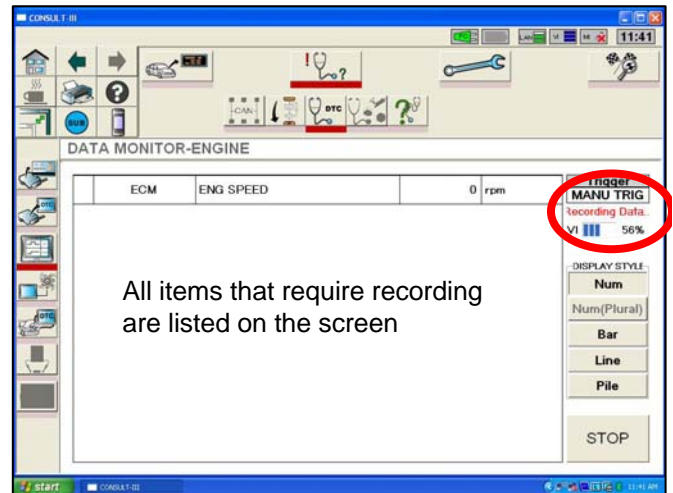
## CONSULT III DATA MONITOR RECORD

5. Once prepared, touch **“RECORD”** on the bottom right of the screen to capture the activity of the engine. Watch the recording time bar graph (circled right). Recording stops at 100%.

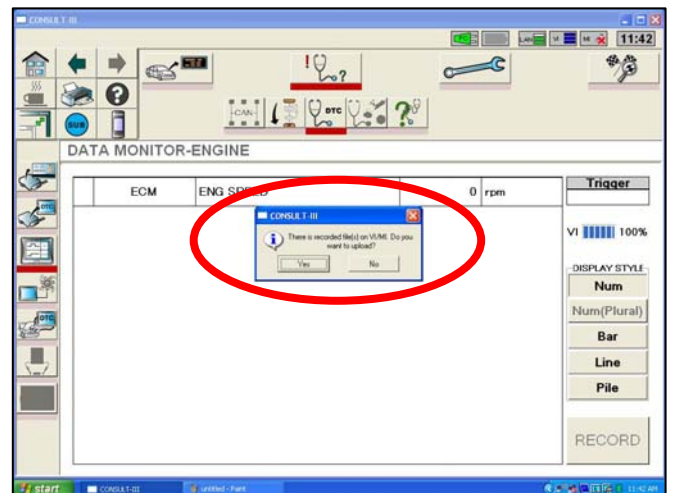
The **example recording activity** is basically as follows;

- (i) Touch record
- (ii) In less than a second start Engine & allow to idle for 1 second
- (iii) Race engine twice & allow to idle again until the end of recording.

The above must be carried out as quickly as possible in order to maximise the recorded data on the graphs

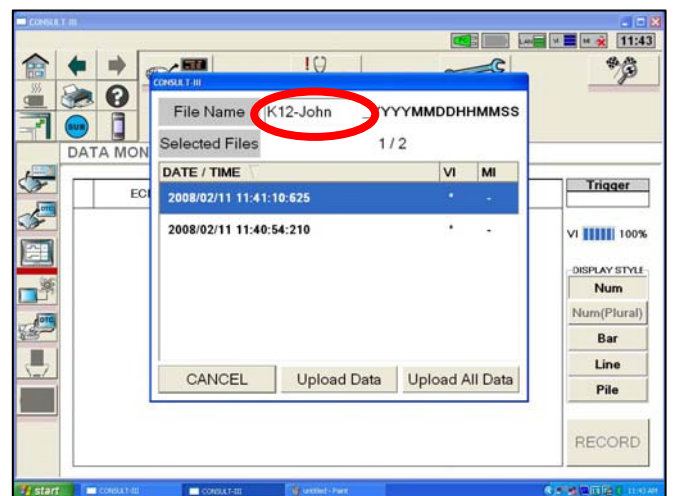


6. Once the recording has stopped, touch the back arrow (top left of screen) once. A message appears on the screen (circled right) – Touch **“Yes”**.



7. (i) Add any text after the model code to make the file name unique (circled right).

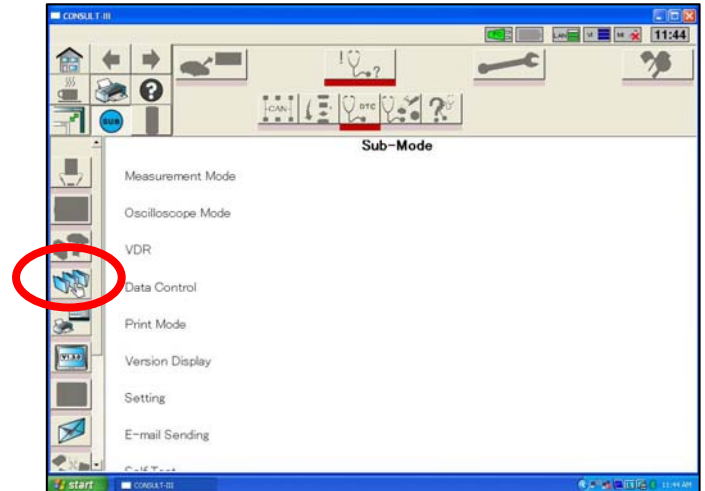
(ii) Highlight the desired data & then touch **“Upload Data”**.



## CONSULT III DATA MONITOR RECORD

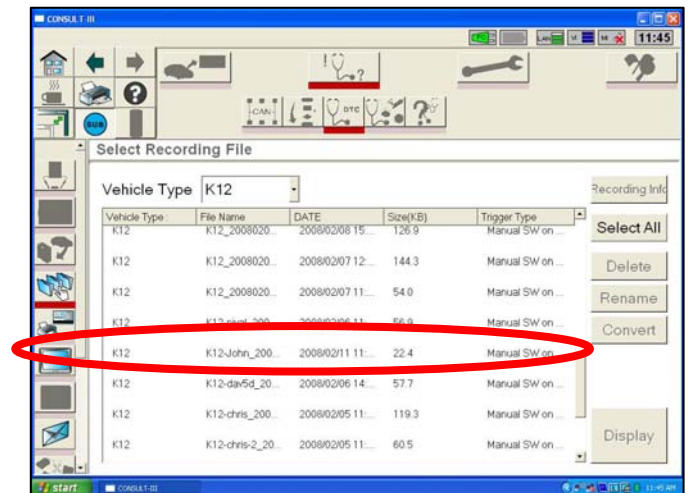
8. (i) Touch **“Sub”**. The main Sub Mode screen will appear over the Data Monitor screen.

(ii) Touch the **“Data Control”** Icon.



9. (i) Highlight the saved file (touch the text area) with the unique name previously given to the file.

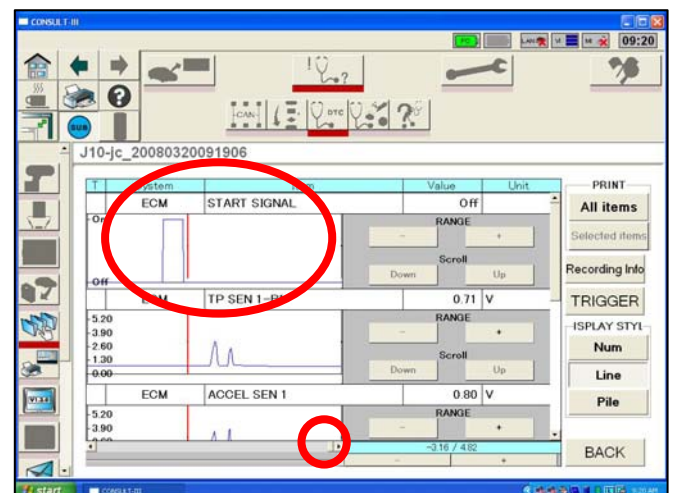
(ii) Touch **“Display”** in the bottom right of the screen.



10. (i) Once the next screen appears, select **“Line”**. This will change the recorded data from Numerical to Line graph.

(ii) Ensure that the desired data is displayed. In this example the **“START SIGNAL”** switching from OFF to ON is clearly seen (large circle). This shows when the engine was cranked over.

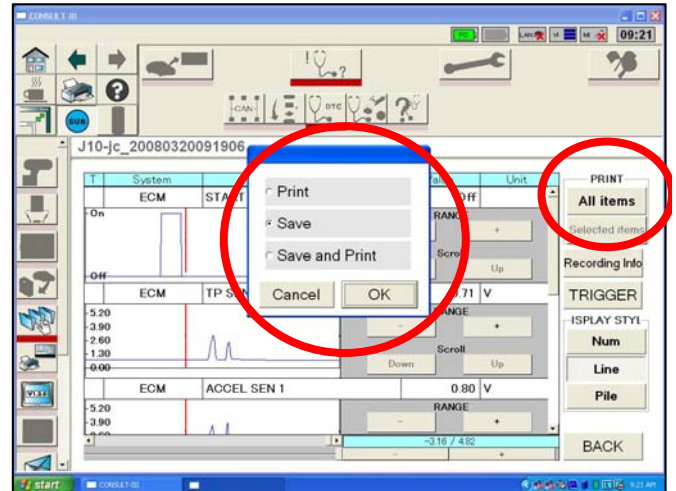
(iii) It's possible to slide the data back in time to catch activity well before **“RECORD”** was touched. Use the small slider tab on the screen to do so. (small circle)



## CONSULT III DATA MONITOR RECORD

11. (i) Touch “All items” button under the “PRINT” title on the RHS of the screen. A small window will then appear as shown right.

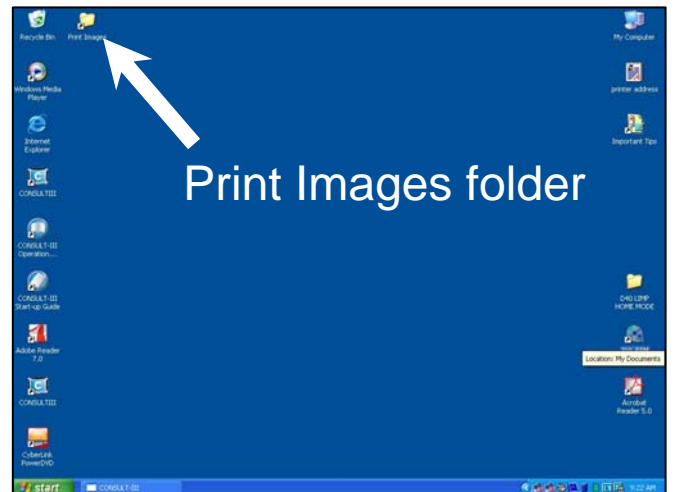
(ii) Touch the “Save” button on the field that next appears, followed by OK. (otherwise select print to actually print the graphs onto paper.)



12. Once “Save” has been selected, the graphs are converted into images which can be easily viewed on any PC. The image files are sent to a specific folder in the C drive of the PC as follows;

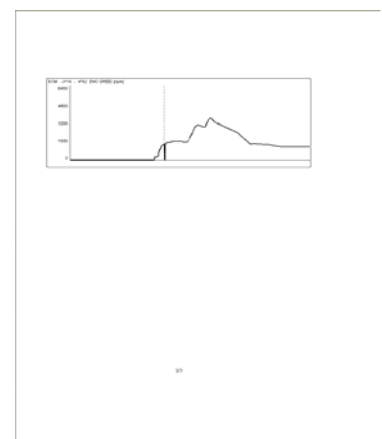
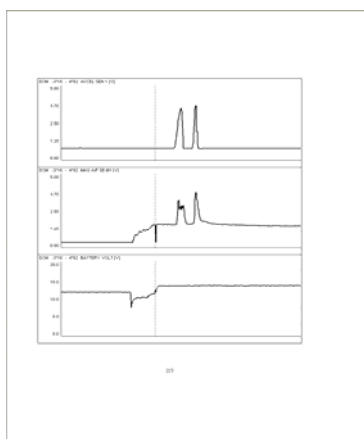
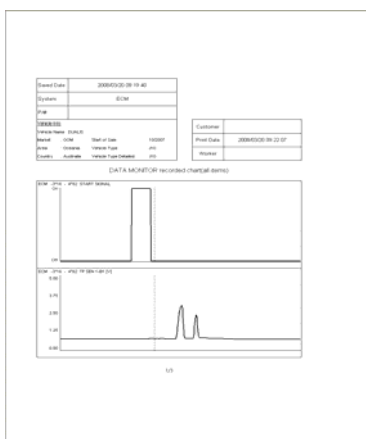
**C:/Consult III/ApplicationData/Print Images**

Locate this folder on the CONSULT III & create a shortcut to the folder on the desktop.



13. THESE FILES CAN BE EASILY ATTACHED TO THE TECHLINE CONTACT. THERE IS NO NEED TO FAX GRAPHS TO TECHLINE ANY LONGER.

The graphs show that once the engine was started, the accelerator pedal was press twice & then the engine returned to idle & then the recording finished.



## ACCELERATOR, FUEL & EXHAUST SYSTEM - FE

### ZD30DDTi CRD Fuel Filter

#### 1. Layout

Refer to the picture shown right. This details the basic configuration of the Filter in the vehicle

#### 2. Fuel Recirculation System

On top of the Filter assembly, there is a device (Fuel Recirculation Valve) designed to recirculate fuel back into the filter after it returns from the Engine. Dependant on the temperature, the fuel either re-enters the filter to warm the fuel in the filter to stop the fuel freezing, or it returns directly to the fuel tank.

#### 3. Hand Primer Pump

If there is a need to prime the fuel system, simply squeezing & releasing the hand pump bulb will perform this operation in EXACTLY the same manner it did with the previous hand pump design.

#### 4. Filter Element

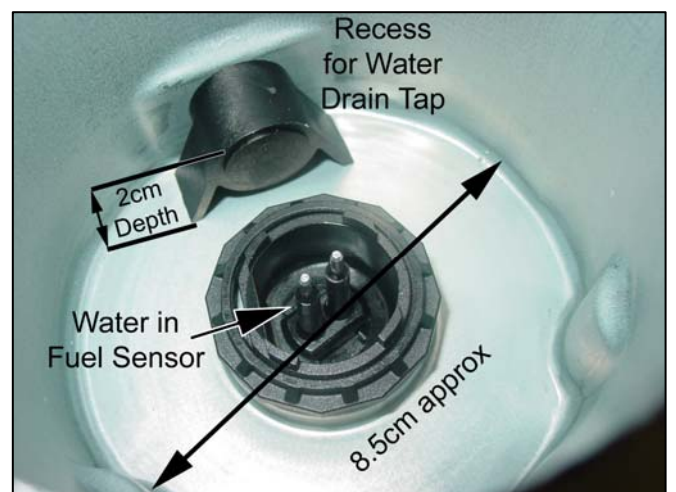
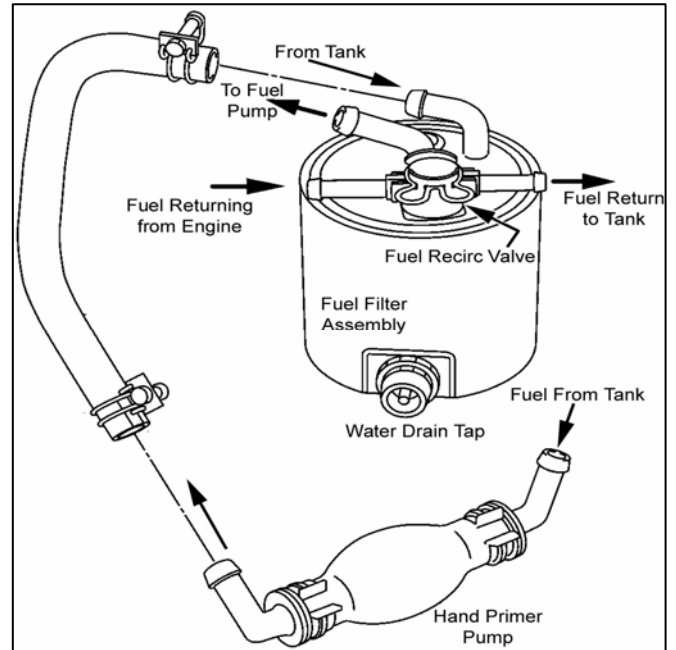
Refer to the picture shown right. This is the element cut out from the steel canister & removed. Fuel enters the canister & is taken from the external side of the filter paper to the inside of the filter paper & then exits the centrally located outlet of the Filter assembly to the Engine (Fuel Pump).

If any water is in the Fuel it will collect in the base of the steel canister.

#### 5. Filter Housing

Refer to the picture shown right. This shows the inside of the steel canister with the element removed. Using the picture, it can be seen the where water is contained. With reference to the picture above as well as this one, it can be seen that there is a 2cm deep reserve for water.

**NOTE:** The Water in Fuel Sensor, Fuel Recirculation Valve & the drain tap come complete with the fuel filter assembly. They are NOT separate parts.



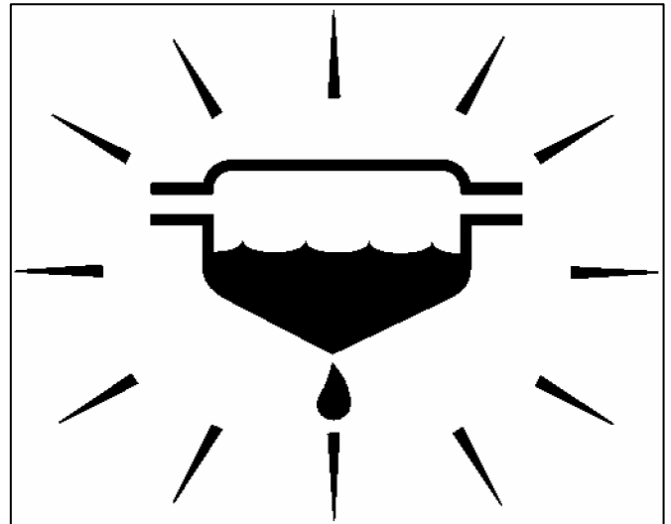
## ELECTRICAL SYSTEM - EL

### Instrument Cluster Warning Lights

#### 1. Water in Fuel Warning System

There is now a separate light to warn the driver of a "Water in Fuel" condition. In previous models the MIL was illuminated to warn the driver of the same condition.

There is a sensor assembly in the base of the Fuel Filter which triggers the light once a set amount of water has collected in the base of the Filter.



#### Water in Fuel Sensor Operation

The sensor measures the electrical conductivity of the liquid it is immersed in.

The sensing element (2 x probes) is approximately 2cm up from the bottom of the fuel filter and provided the filter is full of diesel, (as it normally should be) the resistance across the 2 sensor terminals is measured through the liquid (diesel fuel in this case). The value measured will be the default resistance value of diesel fuel. (Conductivity of diesel).

As water gets into the fuel system, its specific gravity is greater than diesel, causing the water to settle in the bottom of the filter. Once 2cm (approx) of water has settled at the bottom of the filter, the conductivity of water is different to diesel, this in turn triggers the water in fuel warning to be activated.

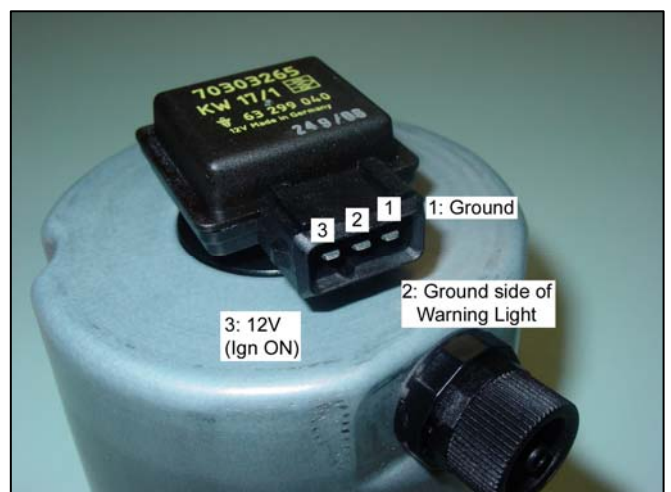
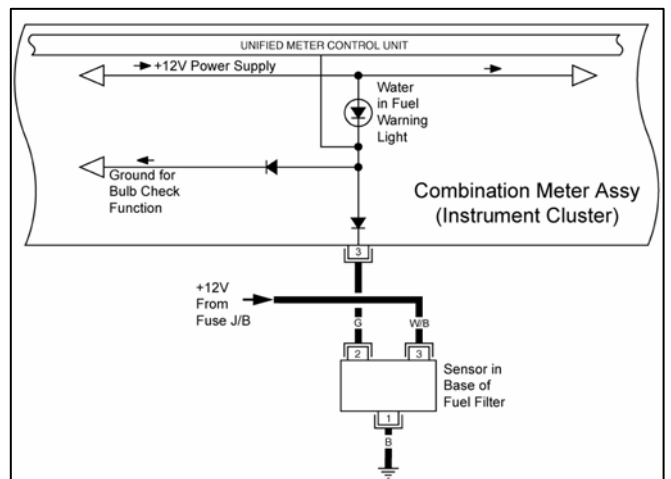
With the ignition ON, power is fed to the sensor unit (terminal 3) in the base of the filter. The sensor unit requires it's own power supply to operate.

Terminal 2 is connected to the Ground side of the globe in the instrument cluster. If this wire is grounded, the globe will illuminate.

Terminal 1 is permanently connected to Ground.

If there is enough water to short the sensor probes inside the filter, (see pic over page) the sensor unit detects this condition & then grounds terminal 2.

In a normal condition, the filter base should ONLY contain diesel fuel, therefore this is not able to short the terminals. Water can conduct electricity (diesel cant) therefore a Water in Fuel condition is detectable.



Filter & Sensor are 1 complete assembly.  
They are NOT separate parts.

Refer to the previous page of this Training Manual for more detail about the Fuel Filter assembly.



## ELECTRICAL SYSTEM - EL

### (i) Water in Fuel Warning Light ON Condition

Refer to the picture shown right. This shows the amount of water necessary (approximately 2cm deep) to create a short between the 2 probes centrally located in the base of the filter housing. This short will trigger the illumination of the Water in Fuel warning light in the instrument cluster.



### (ii) Water in Fuel Warning Light OFF Condition

This picture shown right shows the amount of water remaining AFTER the drain tap has been opened & all possible water has drained out. (Filter remained level)

#### NOTE:

When draining water from the filter, it is **STRONGLY ADVISED** to remove the filter from the bracket & turn the filter onto its side to ensure that the **maximum** amount of water can be **drained out**.



## ELECTRICAL SYSTEM - EL

### Instrument Cluster Warning Lights

#### 2. Low Oil Pressure Warning System

The Oil Pressure warning light on the instrument cluster can be illuminated for 2 different reasons as follows;

1. With an Ignition ON condition, (engine running or not running), the conventional Oil Pressure SWITCH has grounded which in turn illuminates the light.

Typically this occurs normally if the Ignition is ON but engine not running as there is no Engine Oil pressure, therefore the Oil Pressure Switch will connect to ground. Once the engine is started the Oil Pressure Switch will open circuit due to the Oil Pressure acting on the switch.

2. A signal is sent from the ECM to the Instrument cluster via CAN after the ECM has detected the following conditions for MORE than 5 seconds;

- a) Engine rpm: 3600 – 4200rpm
- b) Coolant temp: Less than 95 deg C
- c) Oil pressure: 2.5 BAR or less (Oil pressure sensor voltage less than 2V approx.)

